EXERCÍCIO FÍSICO E DOENÇA ARTERIAL CORONARIANA E INSUFICIÊNCIA CARDÍACA

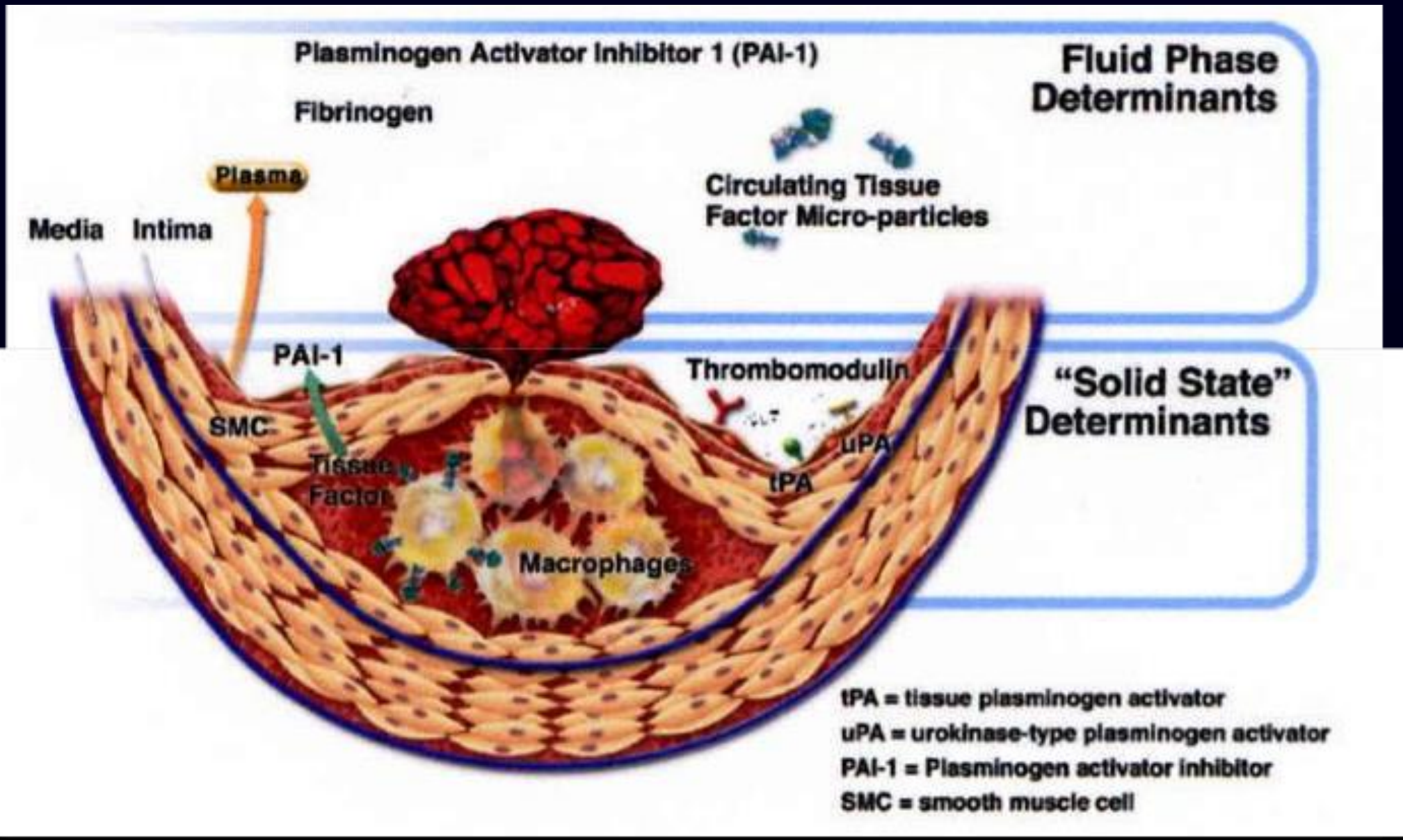
Prof. Dr. Raphael Ritti Dias

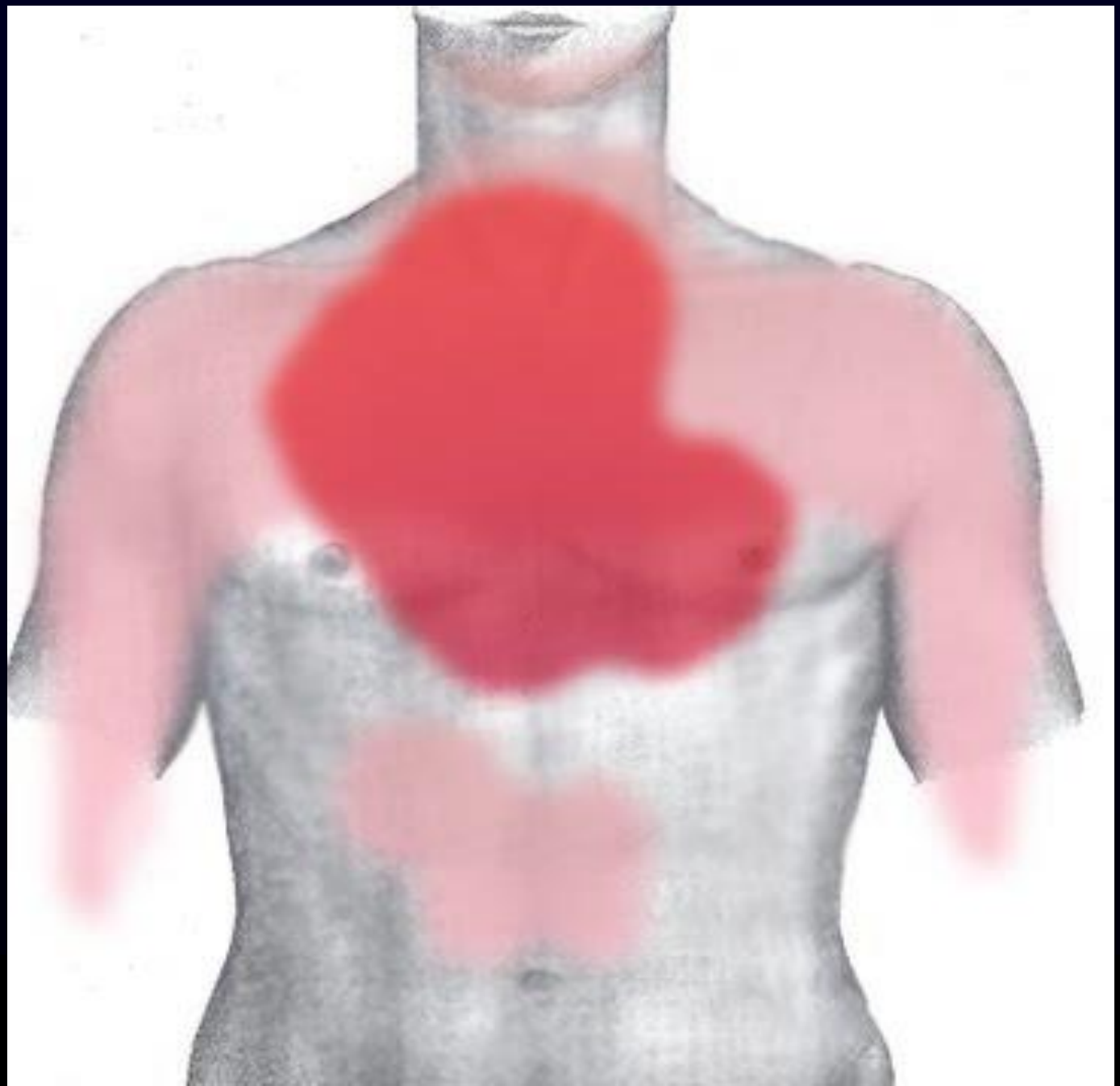
DOENÇA ARTERIAL CORONARIANA

DEFINIÇÃO

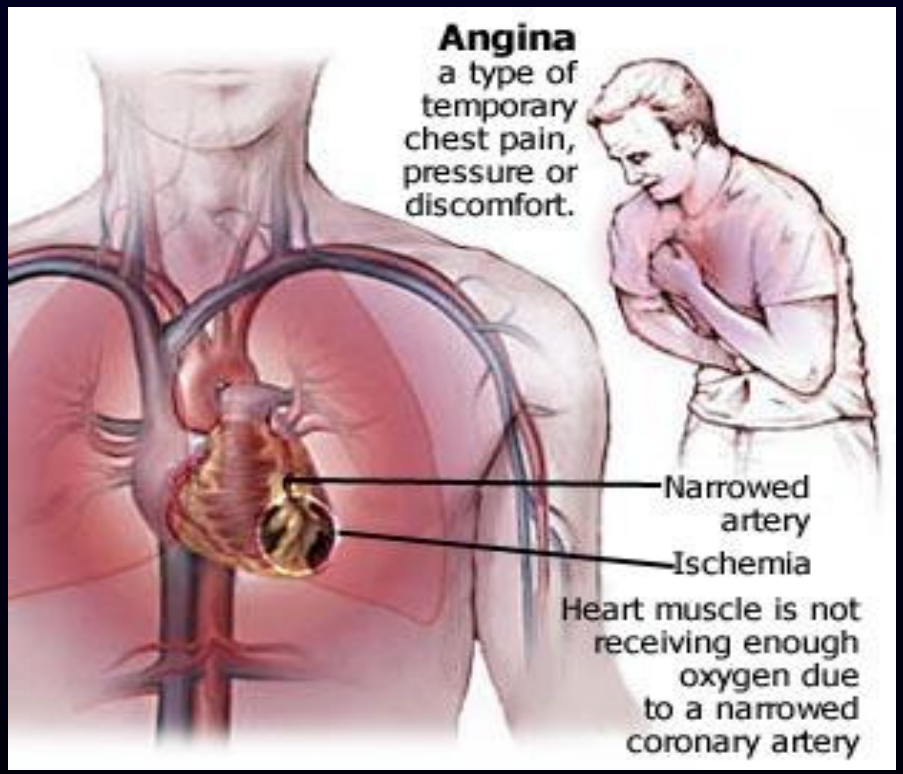
Processo de obstrução da luz das artérias coronárias por aterosclerose, caracterizada por depósito de placa de gordura (ateroma) no endotélio das coronárias, associado a processo inflamatório local, que pode levar a uma obstrução do vaso e interrupção total (necrose) ou parcial (isquemia) do fluxo sanguíneo ao músculo do ventrículo esquerdo.

TROMBOSE

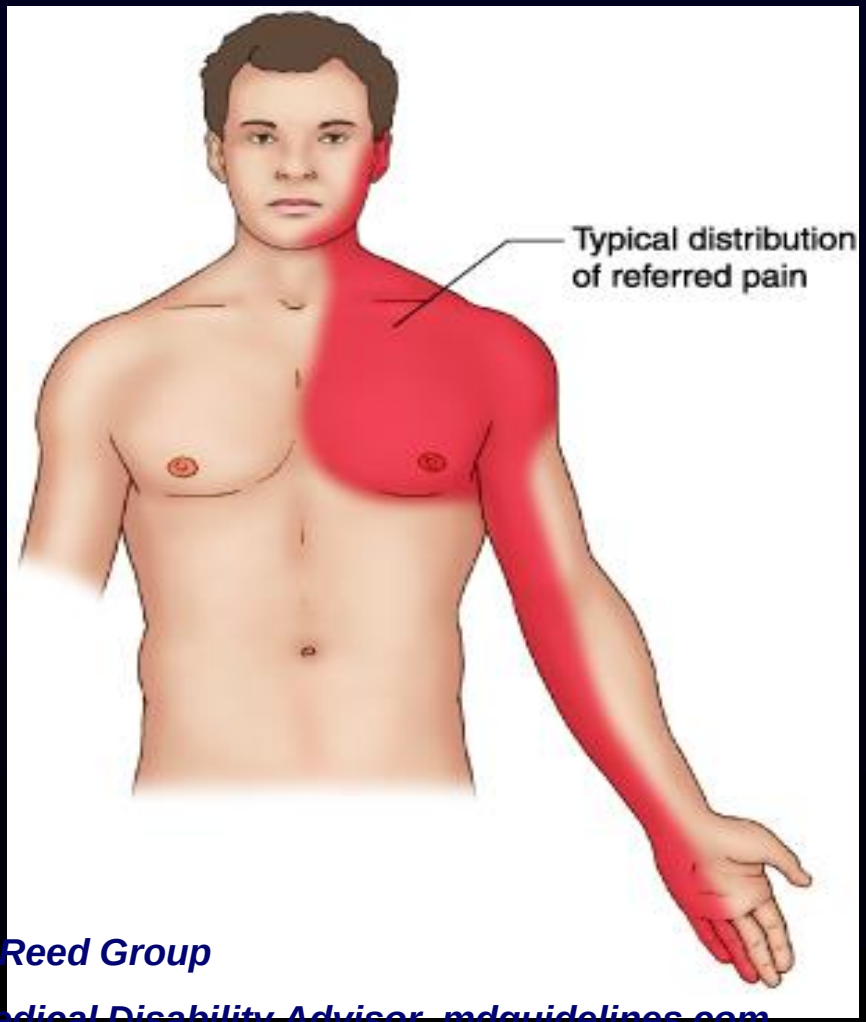

Plasminogen Activator Inhibitor 1 (PAI-1)
Fibrinogen
Fluid Phase Determinants
Circulating Tissue Factor Micro-particles
Plasma
Media
Intima
PAI-1
Thrombomodulin
"Solid State" Determinants
SMC
Tissue Factor
uPA
tPA
Macrophages
tPA = tissue plasminogen activator
uPA = urokinase-type plasminogen activator
PAI-1 = Plasminogen activator inhibitor
SMC = smooth muscle cell



TIPOS DE DOR



New York Heart Associates, nyheart.net



© Reed Group

Medical Disability Advisor, mdguidelines.com

QUAL O IMPACTO DA DAC NA APTIDÃO FUNCIONAL?

Exercise Performance, Physical Activity, and Health-Related Quality of Life in Participants With Stable Angina

Angiology
62(6) 461-466

DOI: 10.1177/0003319711399897
http://ang.sagepub.com
SAGE

Andrew W. Gardner, PhD[1,2,3], Polly S. Montgomery, MS[1,2,3], Raphael M. Ritti-Dias, PhD[4], and Udho Thadani, MD, FACC[5,6]

ANGINA VS. CAPACIDADE FUNCIONAL

Table 2. Exercise Performance and Self-Reported Health of Participants With Stable Angina and Controls[a]

Variables	Control Group (n = 441)	Stable Angina Group (n = 115)	Unadjusted *P*	Adjusted *P*[b]
6-Min walk distance (m)	485 (100)	449 (96)	.003	.037
WIQ distance score (%)	76 (34)	57 (38)	<.001	<.001
WIQ speed score (%)	65 (32)	48 (32)	<.001	<.001
WIQ stair climbing score (%)	67 (35)	48 (36)	<.001	<.001
SPPB score (points)	10.5 (1.2)	10.1 (1.2)	.004	.017
SPPB chair (points)	2.7 (1.1)	2.2 (1.1)	<.001	.002
SPPB stand (points)	3.8 (0.5)	3.8 (0.6)	.714	.890
SPPB walk (points)	4.0 (0.2)	3.9 (0.3)	.040	.109

ANGINA VS. ATIVIDADE FÍSICA DIÁRIAS

Table 3. Physical Activity Measures of Participants With Stable Angina and Controls[a]

Variables	Control Group (n = 441)	Stable Angina Group (n = 115)	Unadjusted *P*	Adjusted *P*[b]
Total LTPA (kcal/day)	212 (226)	144 (157)	.003	.016
Low intensity LTPA (kcal/day)	64 (112)	42 (76)	.050	.082
Moderate intensity LTPA (kcal/day)	127 (164)	93 (120)	.040	.124
High intensity LTPA (kcal/day)	18 (47)	8 (15)	.023	.121
Mean intensity LTPA (kcal/min)	4.8 (1.0)	4.7 (1.0)	.637	.963
Mean duration LTPA (min/day)	47 (52)	34 (34)	.014	.046
Physical Activity Scale (units)	2.3 (1.5)	1.7 (1.2)	<.001	<.001

ANGINA VS. QUALIDADE DE VIDA

Table 4. Health-Related Quality of Life Measurements of Participants With Stable Angina and Controls[a]

Variables (%)	Control Group (n = 441)	Stable Angina Group (n = 115)	Unadjusted *P*	Adjusted *P*[b]
Self-perceived health	80 (17)	63 (24)	<.001	<.001
Physical function	72 (27)	44 (21)	<.001	.669
Role limitations—physical	65 (40)	30 (33)	<.001	.335
Bodily pain	65 (27)	68 (22)	.778	.562
General health	67 (23)	55 (16)	.002	.792
Social function	84 (23)	78 (24)	.543	.933
Role limitations—emotional	77 (38)	60 (44)	.338	.690
Mental health	82 (16)	81 (12)	.859	.847
Vitality	66 (22)	49 (22)	<.001	.219

European Journal of Preventive Cardiology

Original scientific paper

Quadriceps isometric strength as a predictor of exercise capacity in coronary artery disease patients

Kentaro Kamiya[1,2], Alessandro Mezzani[3], Kazuki Hotta[1], Ryosuke Shimizu[1], Daisuke Kamekawa[1], Chiharu Noda[4], Minako Yamaoka-Tojo[1,5], Atsuhiko Matsunaga[1,5] and Takashi Masuda[1,5]

European Journal of Preventive Cardiology
0(00) 1–7

DOI: 10.1177/2047487313492252
ejpc.sagepub.com
SAGE

Table 2. Logistic regression models for different eMETs levels

eMET level	B ± SE	*p*	Odds ratio (95% CI)
5 eMETs			
Maximal QIS (%bodyweight)	0.082 ± 0.017	<0.001	1.086 (1.050–1.122)
Peak heart rate	0.060 ± 0.010	<0.001	1.062 (1.041–1.084)
7 eMETs			
Maximal QIS (%bodyweight)	0.046 ± 0.009	<0.001	1.047 (1.029–1.066)
Peak heart rate	0.044 ± 0.006	<0.001	1.045 (1.032–1.059)
Peak systolic blood pressure	0.014 ± 0.004	0.001	1.014 (1.006–1.023)
Male sex	0.908 ± 0.300	0.002	2.480 (1.378–4.463)
Age	−0.035 ± 0.013	0.009	0.966 (0.941–0.991)
LVEF	0.025 ± 0.011	0.019	1.026 (1.004–1.048)
10 eMETs			
Maximal QIS (%bodyweight)	0.030 ± 0.008	<0.001	1.030 (1.013–1.048)
Peak heart rate	0.025 ± 0.008	0.002	1.025 (1.009–1.041)
Peak systolic blood pressure	0.011 ± 0.004	0.015	1.011 (1.002–1.020)
Age	−0.029 ± 0.013	0.028	0.971 (0.947–0.997)
Male sex	0.945 ± 0.548	0.084	2.573 (0.880–7.529)

OBJETIVOS DO TRATAMENTO

Os objetivos do tratamento incluem:

- **Diminuição do efeito da doença na qualidade de vida e aliviar os sintomas**
- **Redução da mortalidade**
- **Atenução da progressão dos sintomas**

TERAPIA MEDICAMENTOSA ANGINA

Principais drogas usadas na DAC

1) Nitratos

Relaxamento arterial

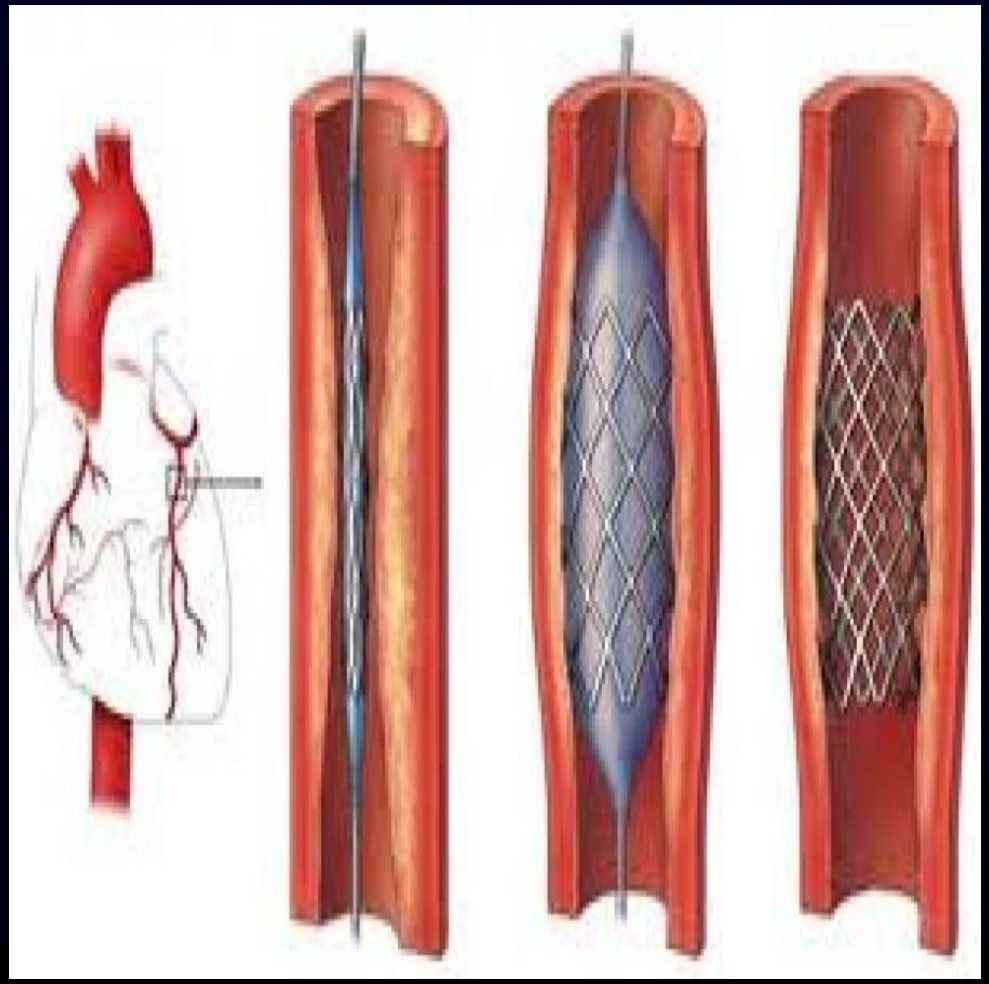
2) Beta bloqueadores

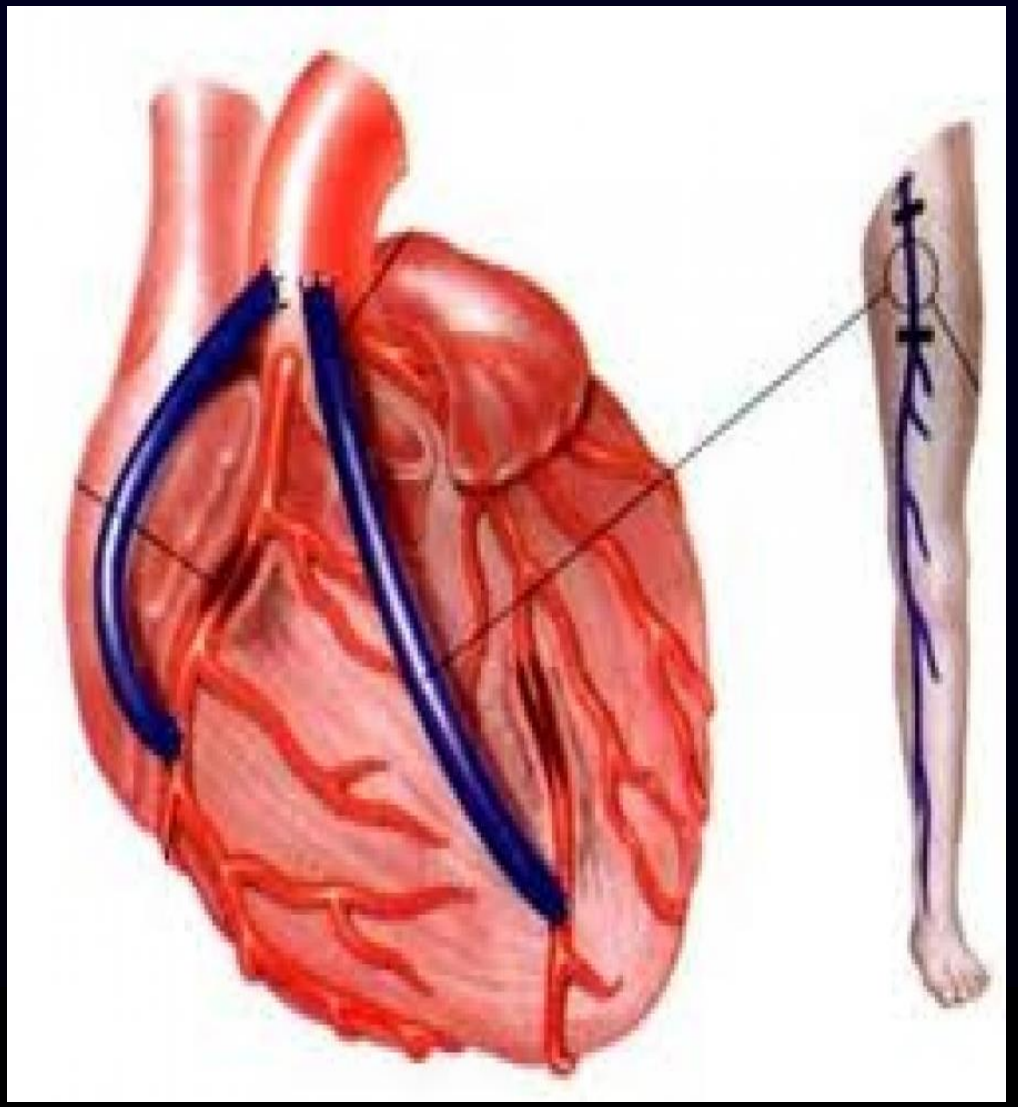
Redução da frequência e força cardíacas

3) Bloqueadores de canal de cálcio

Dilatação arterial e venosa e redução da força cardíaca

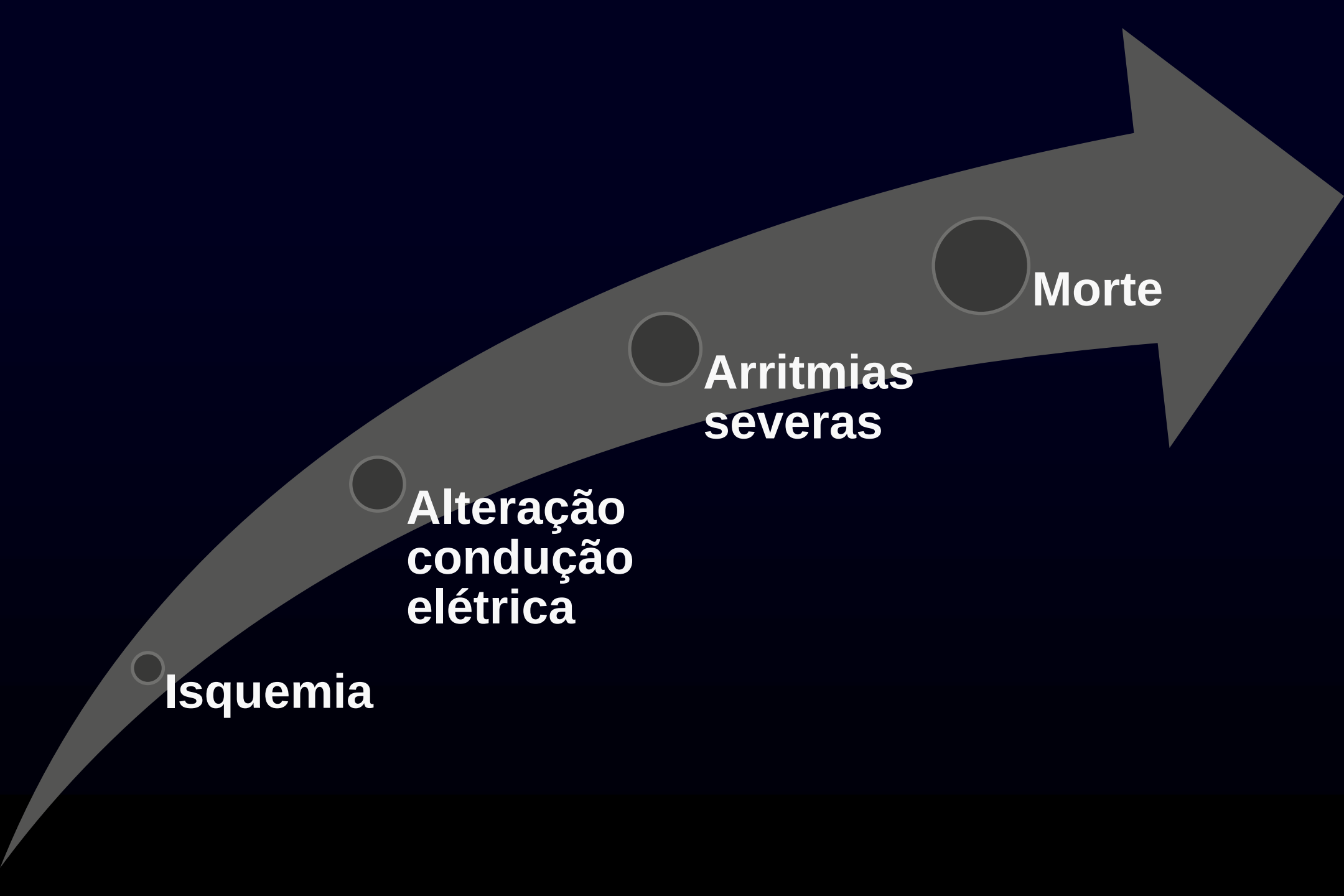
OUTRAS OPÇÕES DE TRATAMENTO





EXERCÍCIO FÍSICO

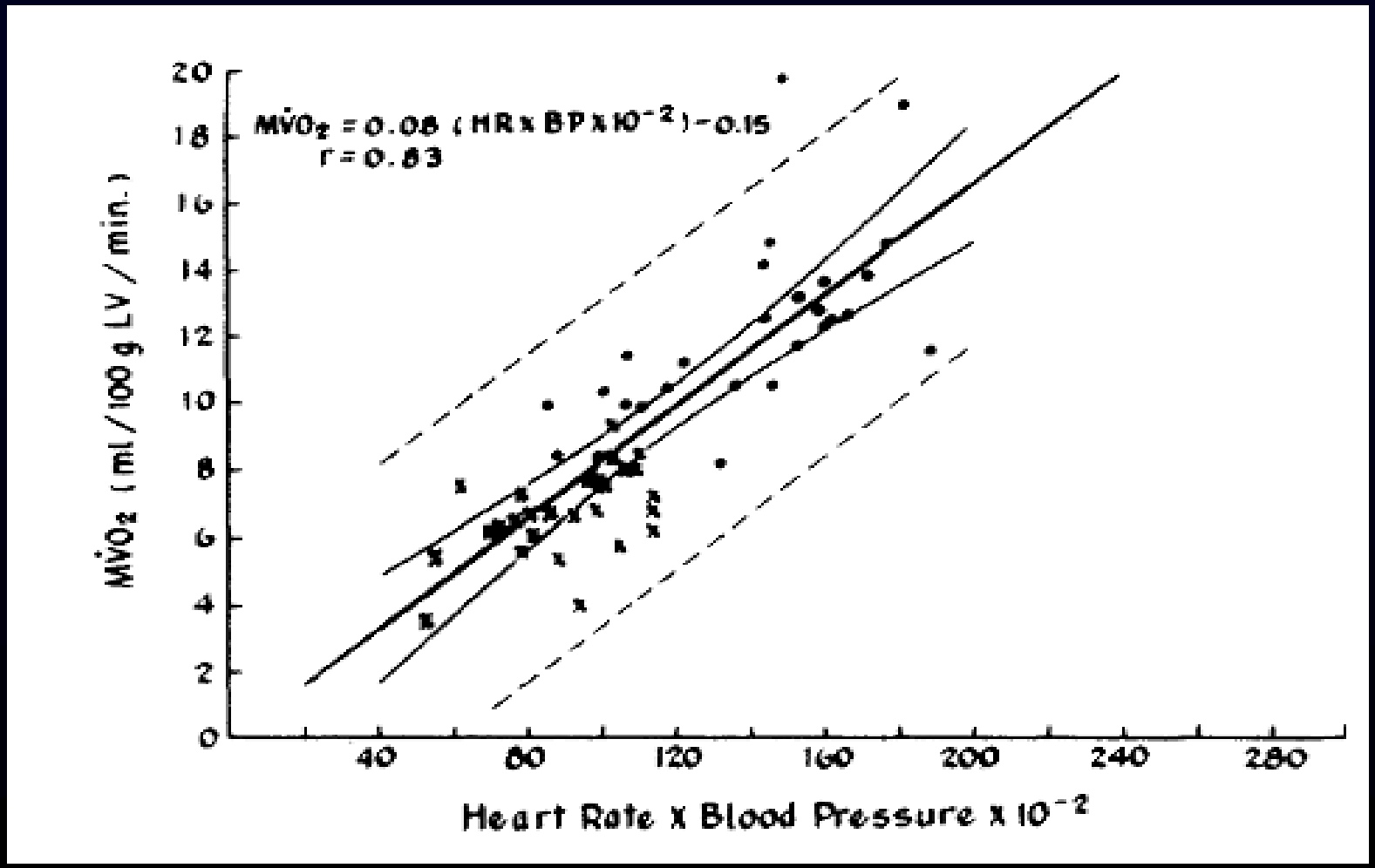
RESPOSTAS AGUDAS AO EXERCÍCIO FÍSICO

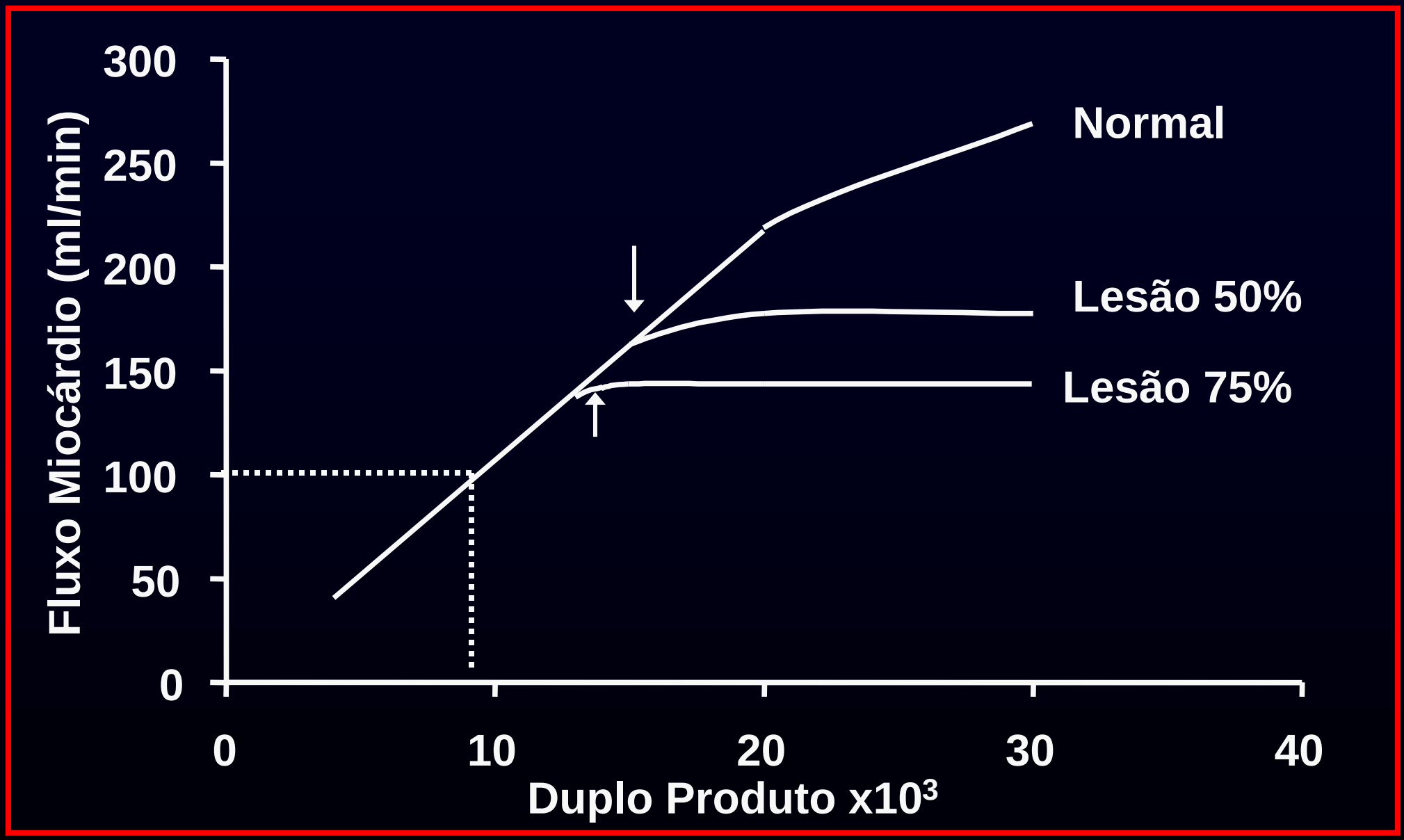

Isquemia
Alteração condução elétrica
Arritmias severas
Morte

The rate-pressure product as an index of myocardial oxygen consumption during exercise in patients with angina pectoris

FL Gobel, LA Norstrom, RR Nelson, CR Jorgensen and Y Wang

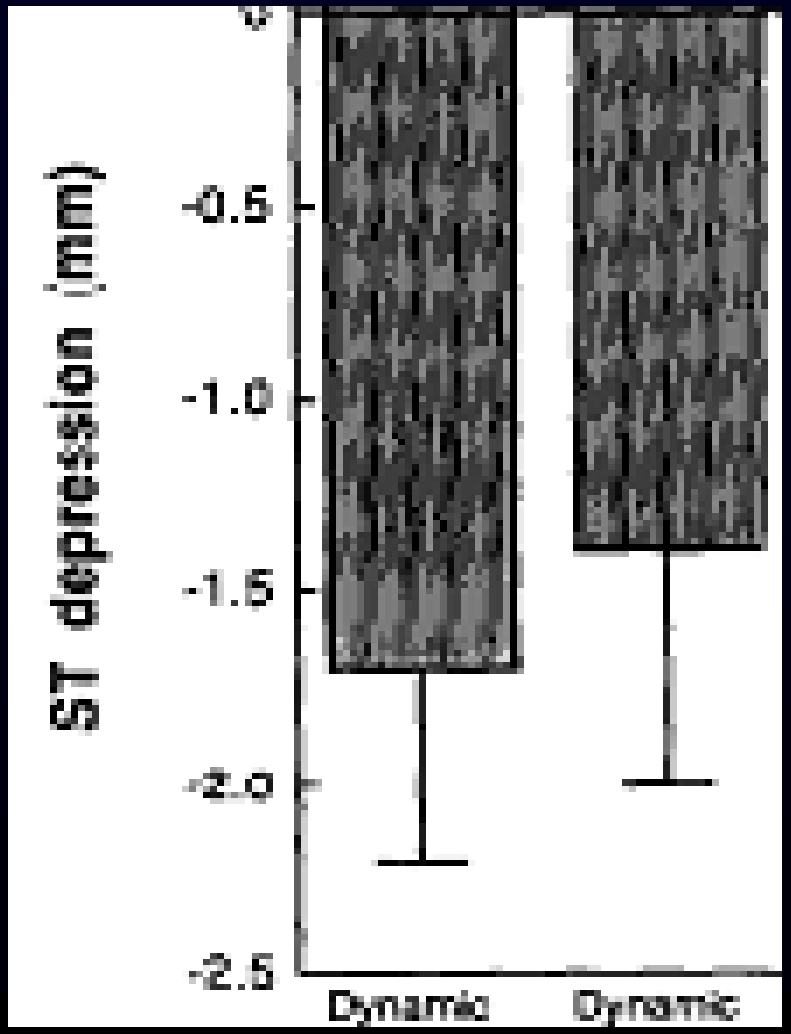
Circulation 1978;57;549-556





Slide Profa. Cláudia Forjaz

CONSISTÊNCIA DA RESPOSTA ISQUÊMICA



Bertagnoli et al., Am J Cardiol (1981)

RESPOSTAS AO EXERCÍCIO DE FORÇA

Physiologic Responses to Weight Lifting in Coronary Artery Disease

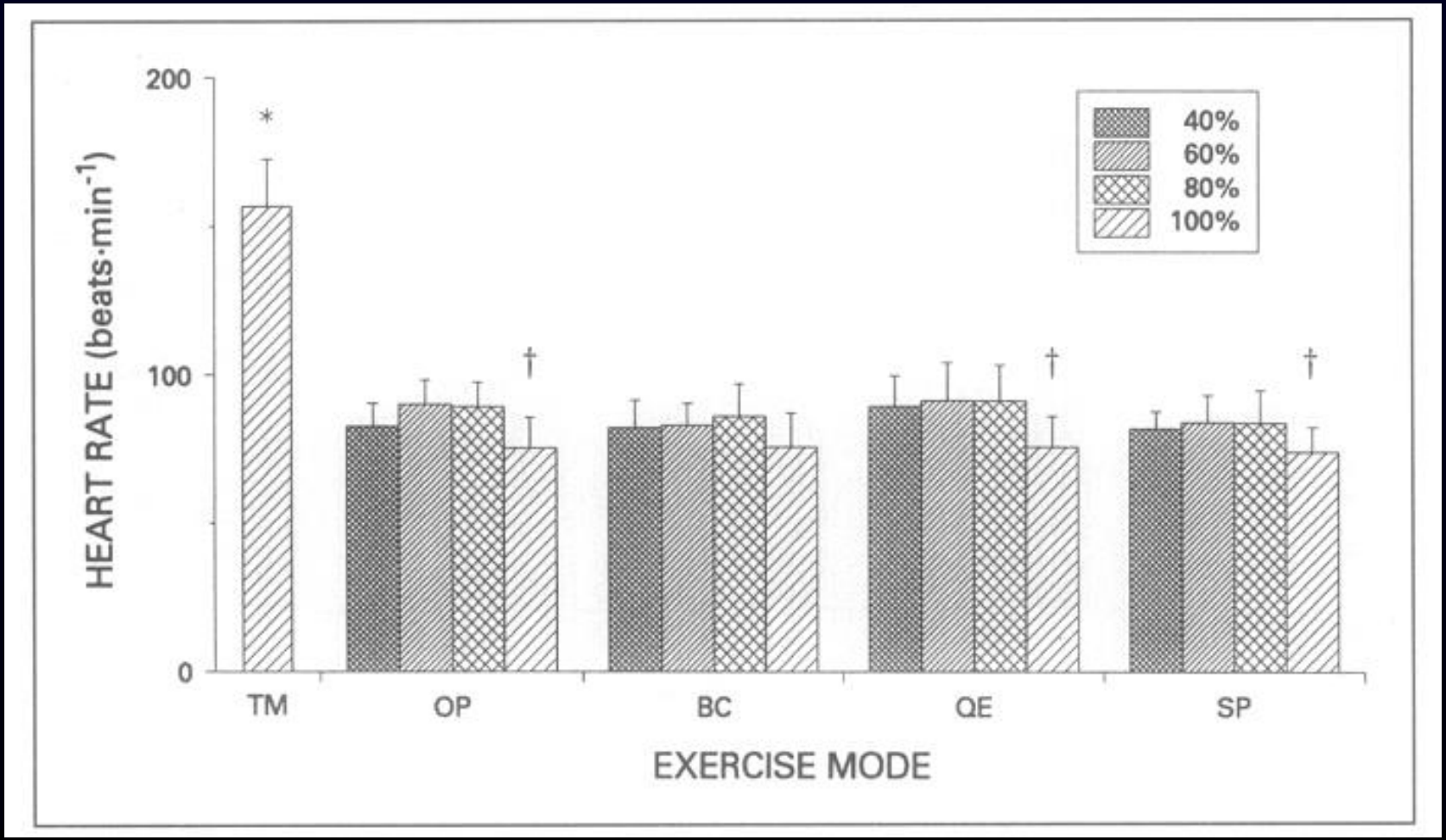
Featherstone, J.F. et al., Am J Cardiol 1993;71:257-292)

- 12 homens (34 a 68 anos de idade)
- 7 tinham infarto
- 2 tinham bypass
- 1 tinha infarto e bypass
- 2 angina
- Todos estavam medicados
- Todos já participavam de reabilitação

- Teste máximo em esteira
- Teste até a fadiga máxima em 40%, 60%, 80% e 100% da CVM
- PA e FC medidos

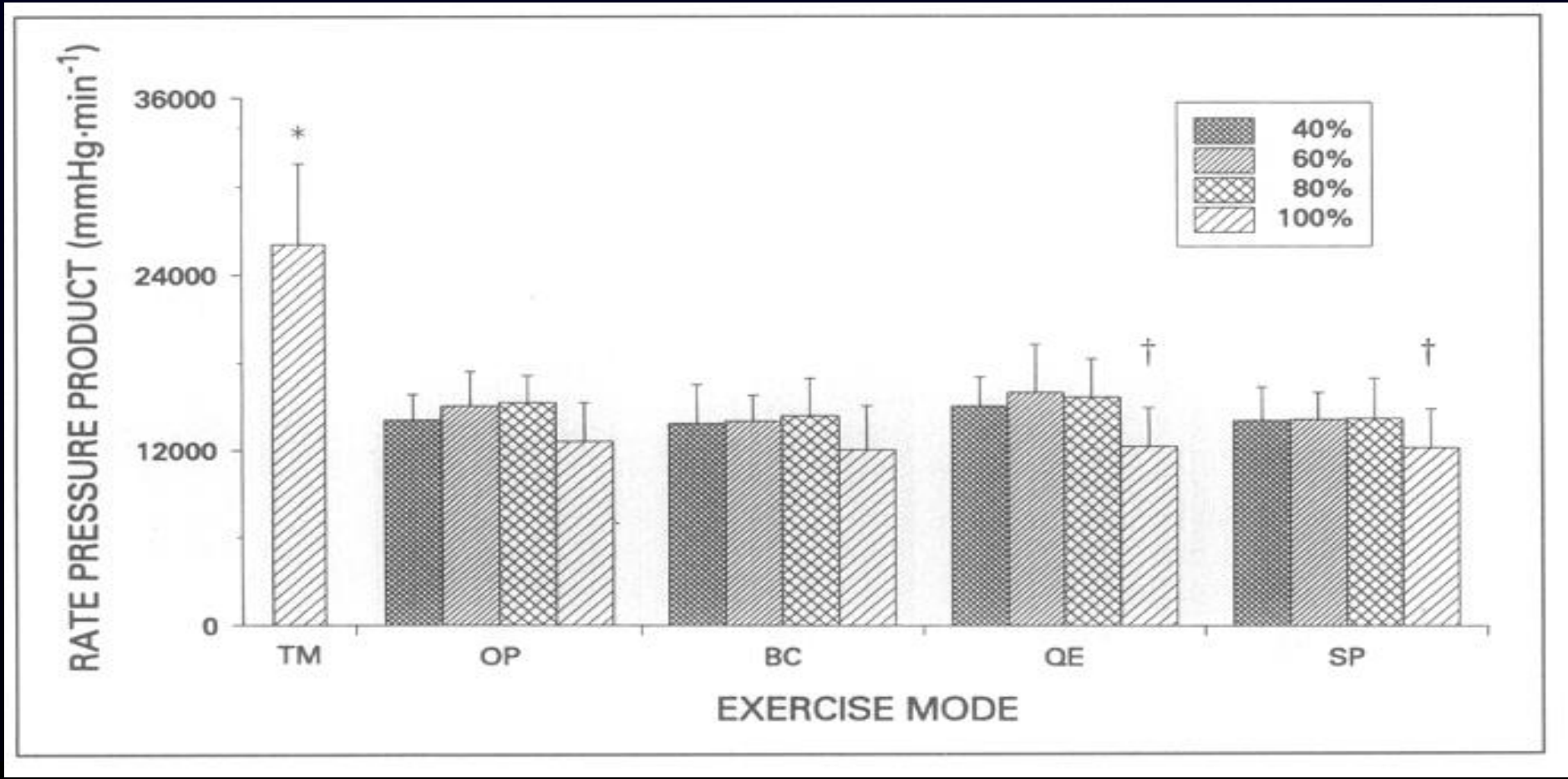
Physiologic Responses to Weight Lifting in Coronary Artery Disease

Featherstone, J.F. et al., Am J Cardiol 1993;71:257-292)



Physiologic Responses to Weight Lifting in Coronary Artery Disease

Featherstone, J.F. et al., Am J Cardiol 1993;71:257-292)



Physiologic Responses to Weight Lifting in Coronary Artery Disease

Featherstone, J.F. et al., Am J Cardiol 1993;71:257-292)

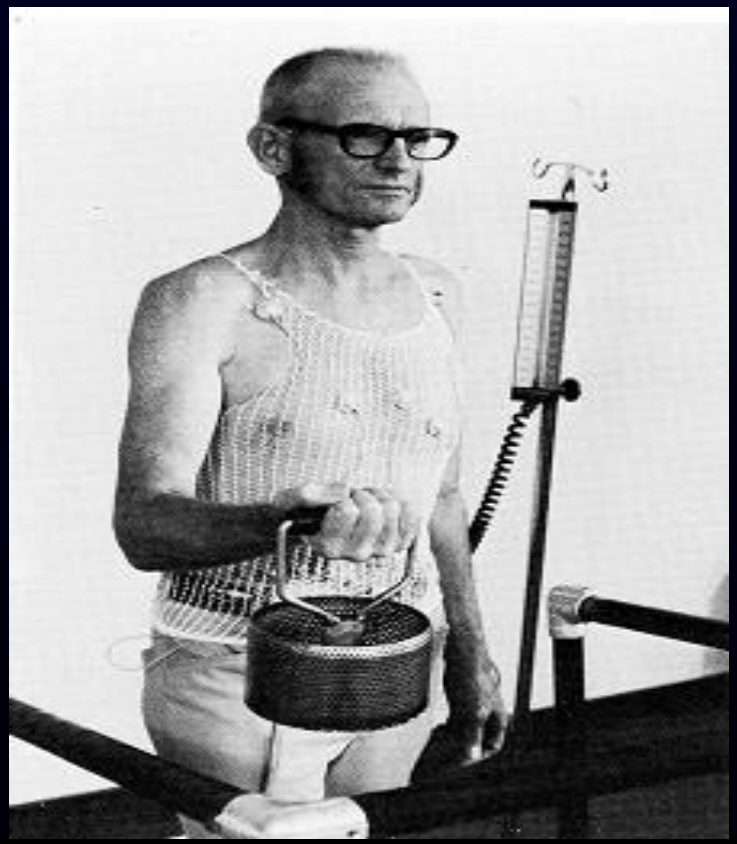
- O exercício dinâmico de força não promoveu respostas cardiovasculares exacerbadas quando comparado a um teste máximo em cardiopatas

- O exercício de maior intensidade (1 RM) promoveu menor aumento da frequência cardíaca e duplo produto.

Comparison of Cardiovascular Responses to Static-Dynamic Effort and Dynamic Effort Alone in Patients with Chronic Ischemic Heart Disease

ROBERT DEBUSK, M.D., WILLIAM PITTS, B.S., WILLIAM HASKELL, PH.D., AND NANCY HOUSTON, R.N.

DeBusk et al. Circulation 58: 368-75, 1978



Comparison of Cardiovascular Responses to Static-Dynamic Effort and Dynamic Effort Alone in Patients with Chronic Ischemic Heart Disease

ROBERT DEBUSK, M.D., WILLIAM PITTS, B.S., WILLIAM HASKELL, PH.D., AND NANCY HOUSTON, R.N.

DeBusk et al. Circulation 58: 368-75, 1978

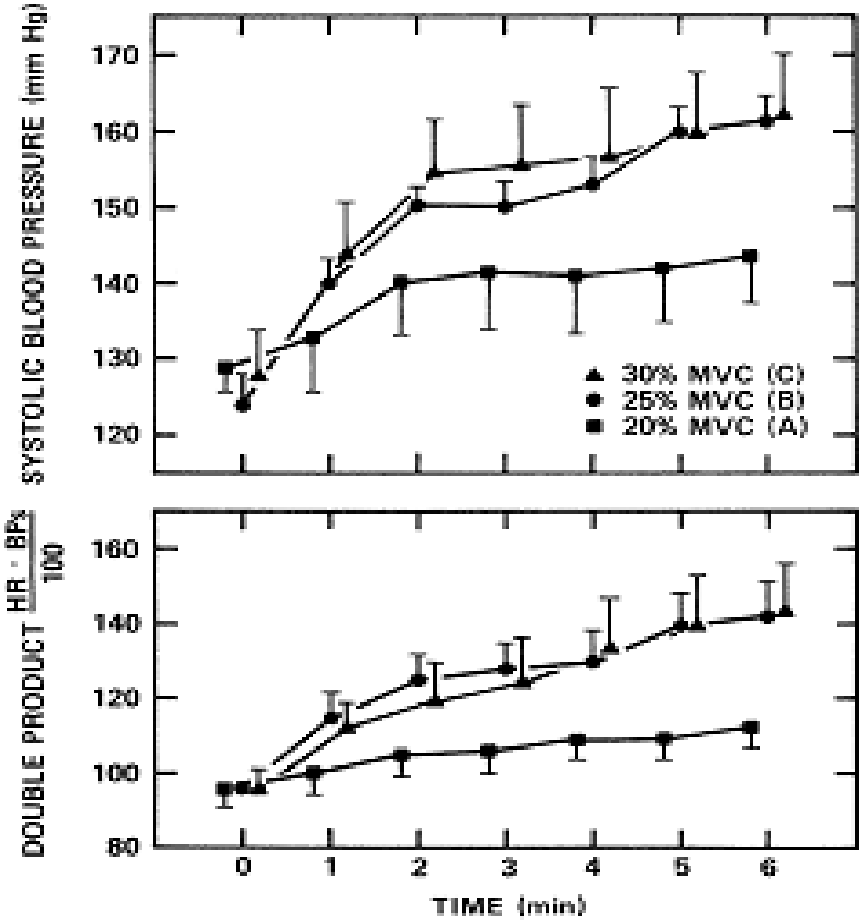


TABLE 3. *Cardiovascular Responses to Dynamic and Static-Dynamic Testing*

	At onset of ischemic ST-segment depression (100 tests)			
	Work load (mets)	Heart rate (beats/min)	Systolic blood pressure (mm Hg)	HR·BPs 100
Static tests (n = 60)	—	—	—	—
Dynamic tests (n = 60)	8.0 ± 0.5	134 ± 3	182 ± 4	218 ± 9
Static-dynamic tests (n = 60)	7.1 ± 0.4§	141 ± 3§	170 ± 4§	239 ± 8§
Within visit comparison				
Average 1st test response	7.4 ± 0.4	134 ± 3	165 ± 4	224 ± 8
Average 2nd test response	7.9 ± 0.4 NS	141 ± 3¶	166 ± 4 NS	237 ± 9 NS

*p < 0.001 vs baseline and vs dynamic

Comparison of Cardiovascular Responses to Static-Dynamic Effort and Dynamic Effort Alone in Patients with Chronic Ischemic Heart Disease

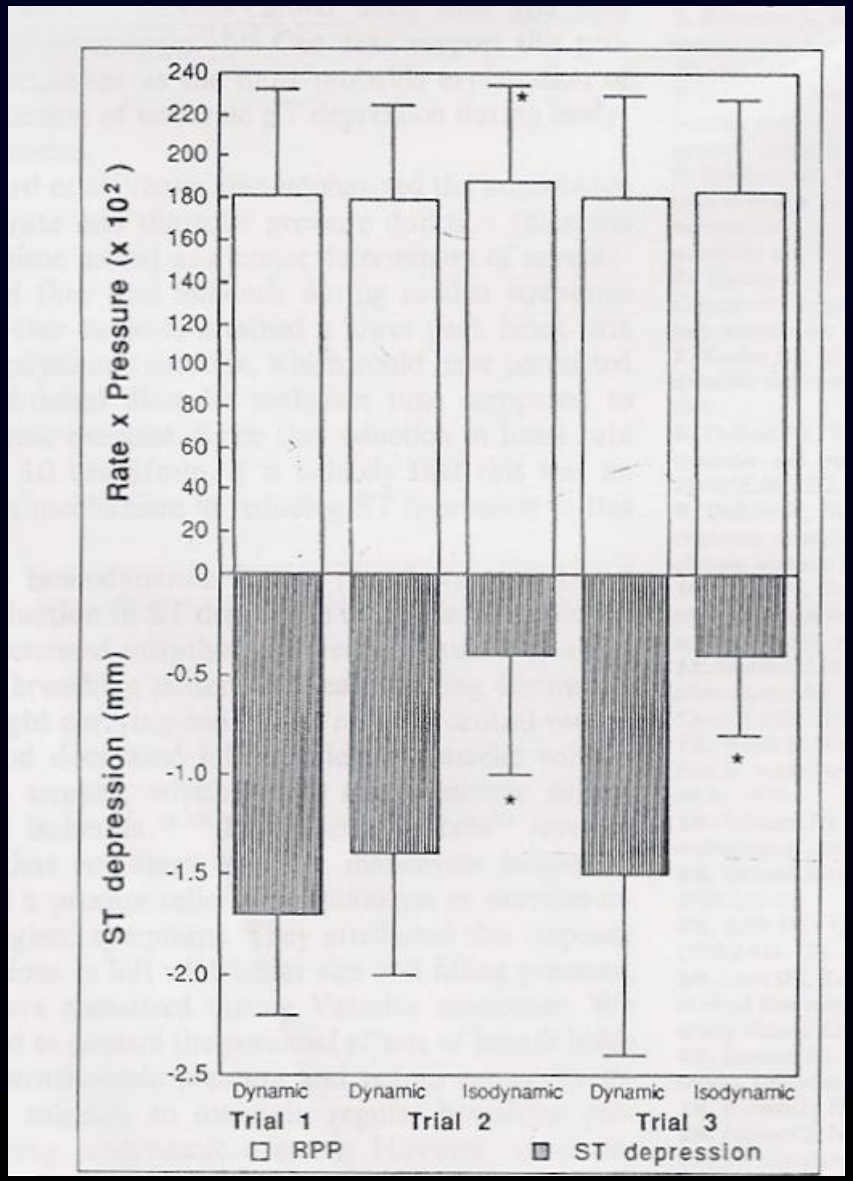
ROBERT DEBUSK, M.D., WILLIAM PITTS, B.S., WILLIAM HASKELL, PH.D., AND NANCY HOUSTON, R.N.

DeBusk et al. Circulation 58: 368-75, 1978

TABLE 5. *Angina Pectoris: Static-Dynamic vs Dynamic Testing*

		Dynamic		
		Present	Absent	
Static-dynamic	Present	19	1	20
	Absent	8	32	40
		27	33	60 visits

SEGURANÇA - ISOTÔNICO MAIS ISOMÉTRICO



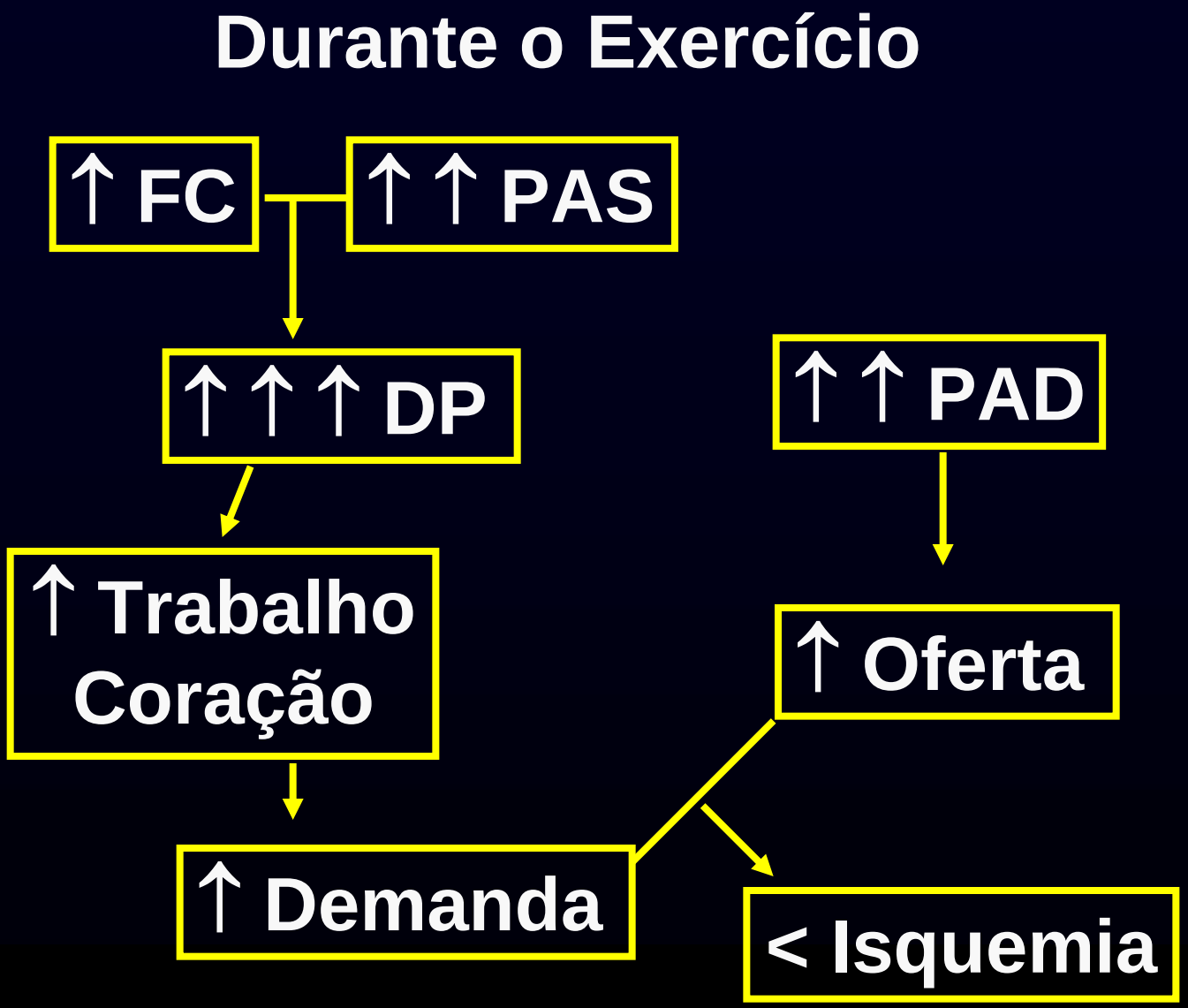
Dinâmico
Esteira
Carga – ST –1 mm

Isodinâmico
Esteira mais peso
Velocidade – ST-1mm

Aumento de PAD – garante fluxo coronário

Bertagnoli et al. Am.J.Physiol. 65:314-7,1990

EXERCÍCIO COM GRANDE COMPONENTE ISOMÉTRICO



EFEITOS CRÔNICOS DO TREINAMENTO NA DAC

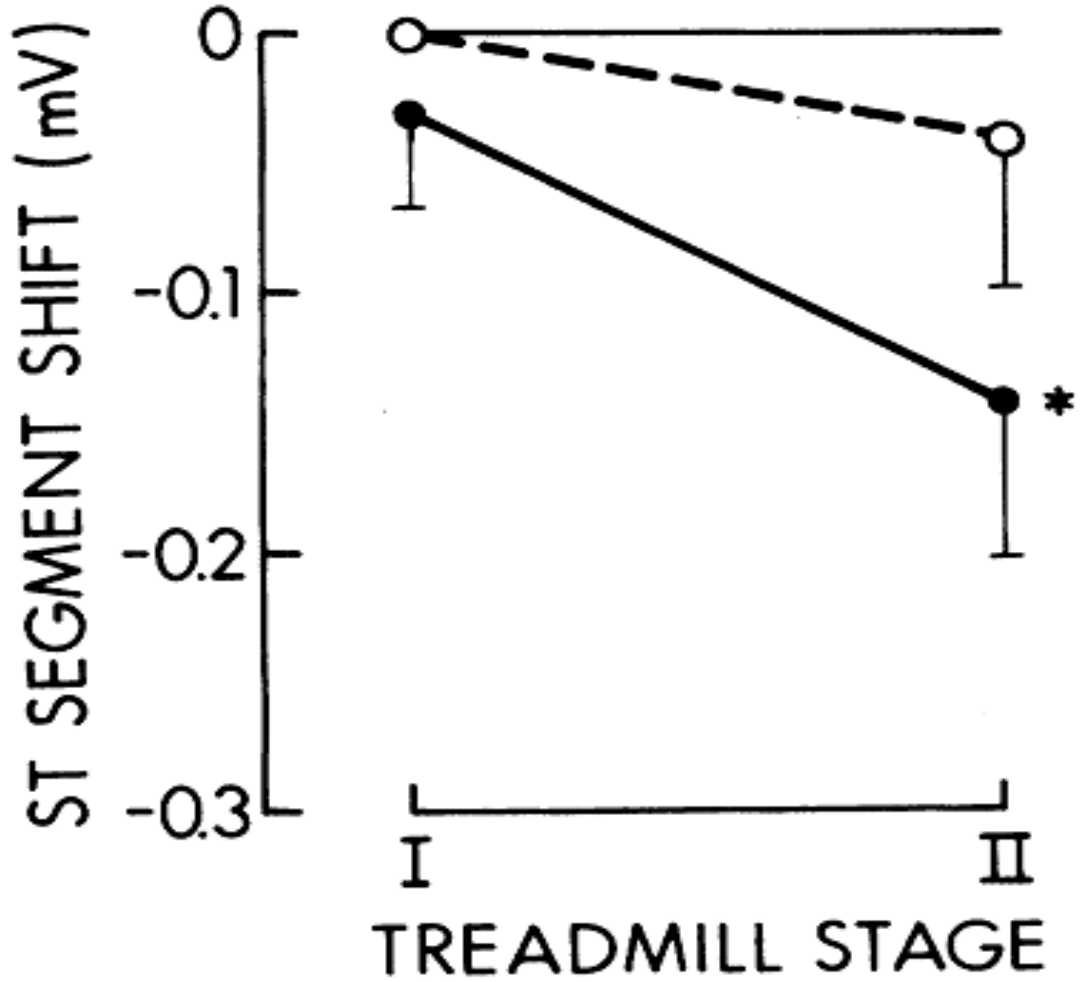
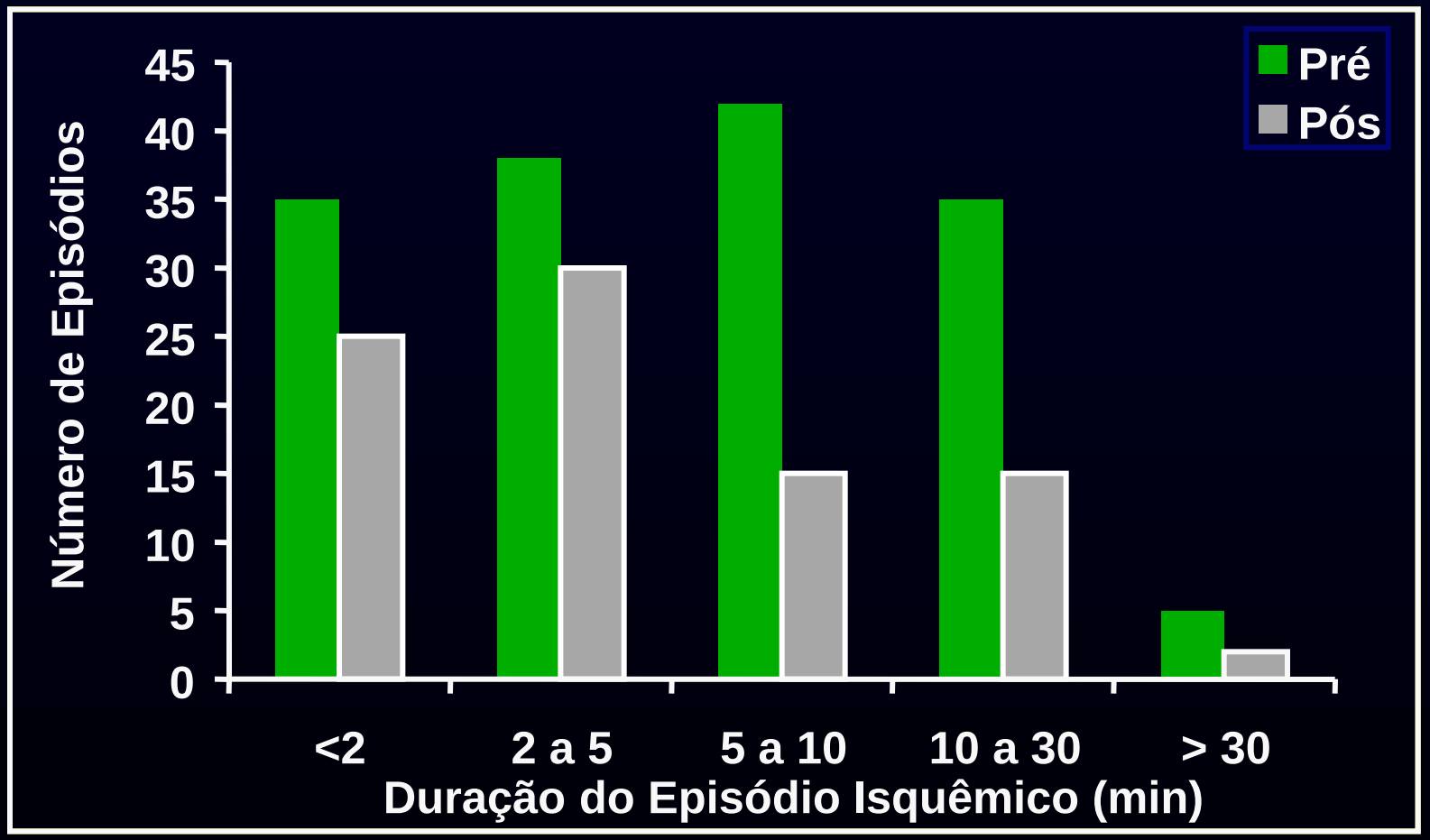


FIGURE 2. *Double product and the extent of ischemic ST-segment depression at two submaximal levels of treadmill exercise (Bruce protocol) before (●———●) and after (○———○) 12 months of exercise training. Values are*

Ehsani et al., Circulation (1981)

EFEITOS DO TREINAMENTO FÍSICO AERÓBIO NA ISQUEMIA



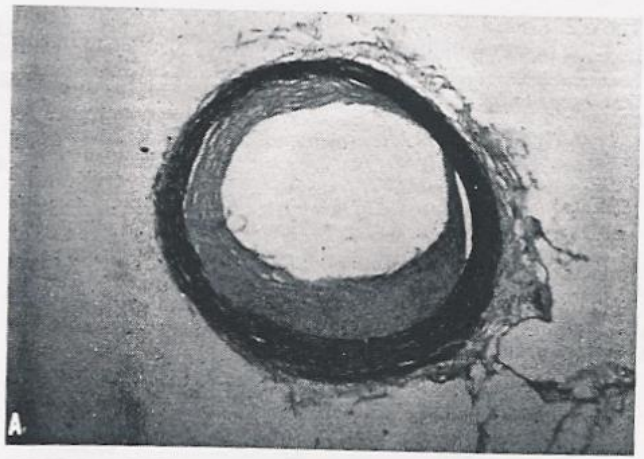
Todd e Ballantyne Br.Heart J. 68:560-6,1992.

EFEITOS DO TREINAMENTO FÍSICO AERÓBIO NA REGRESSÃO DA PLACA

Dieta baixa gordura + exercício

- **Controle - ↑ 0,13 mm**
- **Intervenção - → placa**
- **Intervenção com mais 9204kJ/semana - ↓ placa**

Hambrecht et al. JACC 1993; 22:468-77



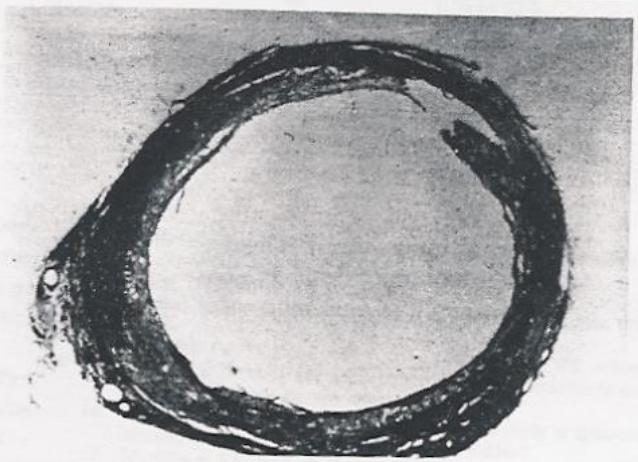


Figure 4. Micrographs of Sections through Comparable Predetermined Segments of the Main Left Coronary Artery, Perfusion-Fixed under the Same Pressure, from Monkeys on an Atherogenic Diet for 24 Months (Verhoeff–Van Gieson Stain, ×30).

Panel A depicts a sedentary monkey, showing considerable luminal narrowing (52 per cent) by a lesion consisting predominantly of fibrotic (collagenous) thickening of the intima. Panel B depicts an exercise-conditioned monkey, showing much less narrowing (7 per cent) by a rather flat lesion consisting predominantly of lipid-laden foam cells; note the much wider arterial lumen in the exercised monkey than in the sedentary monkey, including the internal elastic laminar lumen, as indicated by the internal elastica in both.

Aumento de calibre da coronária

Kramsch et al. N. Engl. J. Med 305:1483-9, 1981.

Treinamento Aeróbio e Circulação Coronariana

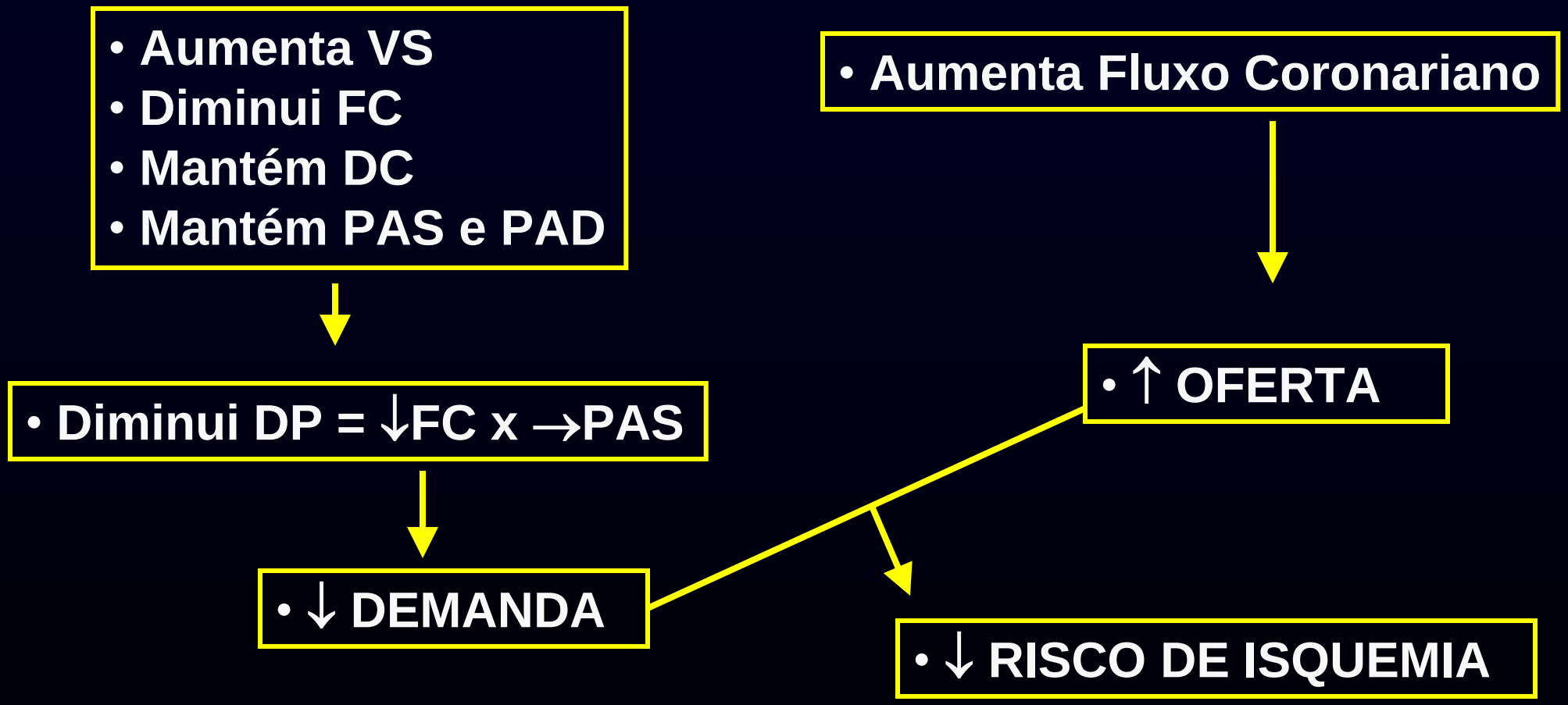
- ❖ Regressão da Arterosclerose
- ❖ Formação de colaterais
- ❖ Formação de novos vasos
- ❖ Melhora da função endotelial

↑ Fluxo sanguíneo

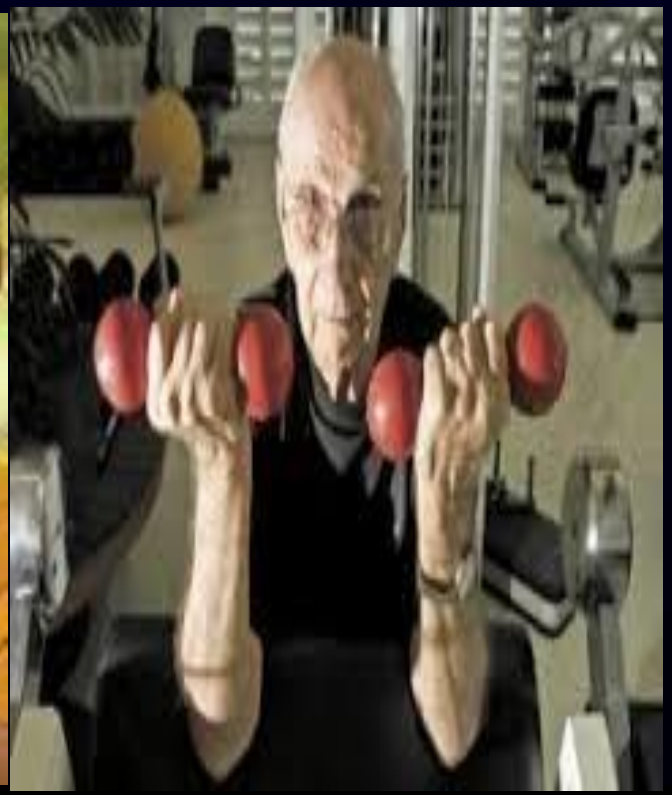
↑ Oferta de sangue

Linke et al. Progress in Cardiov Dis 2006; 48:270-84

EFEITOS DO TREINAMENTO AERÓBIO



Treinamento de força



Resistance Training on Physical Performance in Disabled Older Female Cardiac Patients

Ades, P.A. et al. *Med. Sci. Sports Exerc.*, 35:1265–1270, 2003

- 42 mulheres com DAC (65 a 88 anos)

- Continuous-Scale Physical Performance Test

- Continuous-Scale Physical Performance Test (AFD)

- Capacidade funcional

Resistance Training on Physical Performance in Disabled Older Female Cardiac Patients

Ades, P.A. et al. *Med. Sci. Sports Exerc.*, 35:1265–1270, 2003

Treinamento de força

- 3 x na semana (6 meses)

- 1 série com 10 repetições (aumento para 2 séries)

- 50% de 1 RM e após 2 semanas foi para 80% de 1 RM

- 1) leg extensions (quadriceps); 2) leg press (gluteals, quadriceps); 3) leg curls (hamstrings); 4) shoulder press (deltoids, triceps); 5) arm curls (biceps); 6) lateral pull-down (latissimus, biceps); 7) bench press (pectoralis); and 8) tricep extension (triceps)

Resistance Training on Physical Performance in Disabled Older Female Cardiac Patients

Ades, P.A. et al. *Med. Sci. Sports Exerc.*, 35:1265–1270, 2003

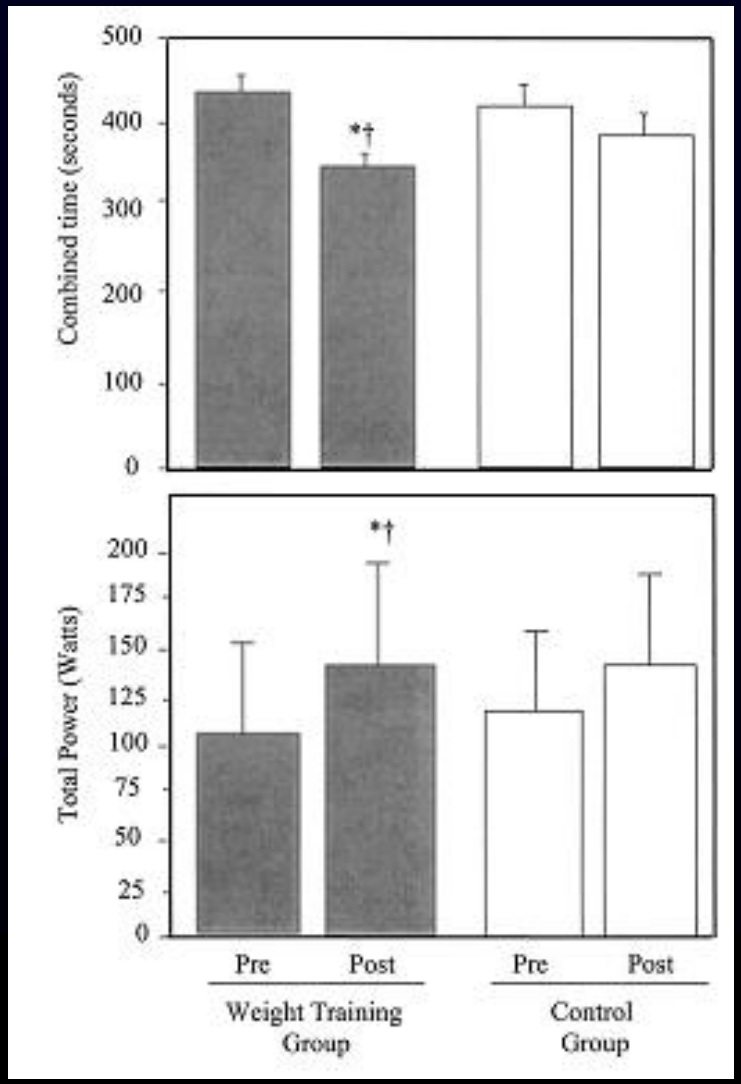
TABLE 2. Specific physical performance measures.

	Total Population (N = 33)		Resistance Group (N = 19)		Flexibility Group (N = 14)		P Value between Groups	
	Baseline Time (s)	Baseline Weight (kg)	ΔTime (s)	Δ Weight (kg)	Δ Time (s)	Δ Weight (kg)	Δ Time	Δ Weight
PotCarry	5 ± 1	11.8 ± 4.6	−1 ± 1**	+3.0 ± 3.4**	0 ± 1	+1.8 ± 3.1*	0.007	NS
Milk jug pour	8 ± 3	-	−1 ± 1**	-	+0 ± 1	-	0.0008	-
Jacket	16 ± 6	-	−3 ± 4*	-	+1 ± 9	-	NS	-
Shoestrap	7 ± 4	-	−1 ± 2*	-	−1 ± 3	-	NS	-
Scarves pickup	6 ± 3	-	−1 ± 2	-	−1 ± 2	-	NS	-
Height reach (cm)	201 ± 17	-	+1 ± 8	-	+1 ± 9	-	NS	-
Floor sweep	21 ± 10	-	4.1 ± 7.6*	-	−3 ± 8	-	NS	-
Laundry load	31 ± 10	-	−4 ± 6**	-	−2 ± 9	-	NS	-
Dryer load	23 ± 8	-	−2 ± 3**	-	+0 ± 6	-	NS	-
Bedmaking	103 ± 47	-	−30 ± 32**	-	−1 ± 29	-	0.013	-
Vacuum	93 ± 39	-	−27 ± 46*	-	−7 ± 37	-	NS	-
Up from floor	17 ± 10	-	−3 ± 3**	-	−3 ± 6	-	NS	-
Open fire door	4 ± 2	-	−1 ± 1**	-	+0 ± 1	-	0.009	-
Luggage on to bus	26 ± 11	8.2 ± 3.1	−4 ± 4**	+2.2 ± 2.9**	+3 ± 7	+2.9 ± 1.9**	0.0012	NS
Grocerycarry	75 ± 23	9.2 ± 4.0	−2 ± 1.9	+3.0 ± 2.6**	+5 ± 17	+1.3 ± 2.4	NS	0.067
Stair climb	8 ± 2	-	−1 ± 1**	-	+0 ± 2	-	0.019	-
6-min walk (feet)	1215 ± 341	-	+161 ± 192**	-	+63 ± 167	-	.11	-

Δ change

Resistance Training on Physical Performance in Disabled Older Female Cardiac Patients

Ades, P.A. et al. *Med. Sci. Sports Exerc.*, 35:1265–1270, 2003



DOENÇA ARTERIAL CORONARIANA

EXERCÍCIO DE FORÇA

- **Melhora a capacidade funcional**
- **Melhora o VO_2 pico**
- **Melhora a força e resistência muscular**
- **Melhora a qualidade de vida**
- **Melhora movimentos da atividades da vida diária**

Combined endurance/resistance training early on, after a first myocardial infarction, does not induce negative left ventricular remodelling

Schmid, J.P et al., Eur J of Cardiol Prev and Rehab,15:341–346: 2008

- 38 pacientes cardiopatas (56 ± 9 anos)

- Todos tinham infarto agudo do miocárdio

Treinamento por 3 meses (3 x semanais)

- Randomizados em Grupo Aeróbio e Combinado

- Pré, 3 e 12 meses, os pacientes foram submetidos a ressonância magnética do coração, teste ergoespirométrico e força do quadriceps avaliado no dinamômetro isocinético

Combined endurance/resistance training early on, after a first myocardial infarction, does not induce negative left ventricular remodelling

Schmid, J.P et al., Eur J of Cardiol Prev and Rehab,15:341–346: 2008

Grupo Aeróbio (70 a 85% da FC máx)

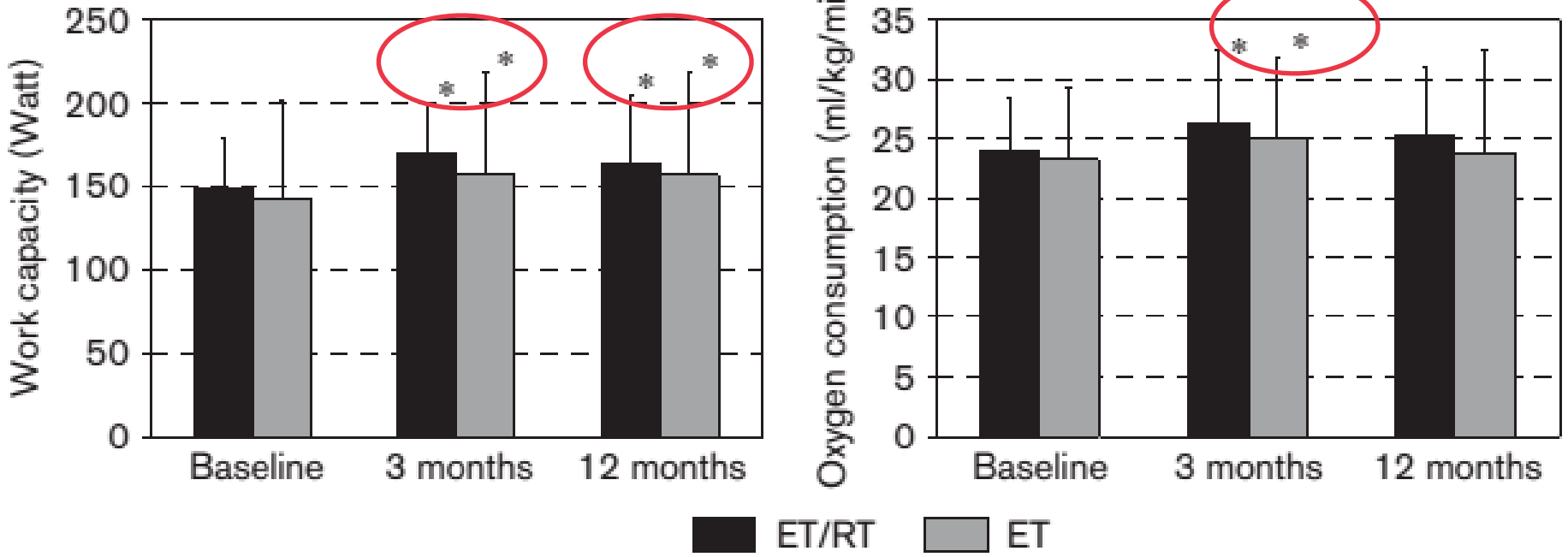
Grupo Combinado - endurance e TF (40% RM, 60% RM)
- 2 séries com 10 repetições (60 seg)

- Os exercícios foram Leg press, leg curl, back extension, abdominal crunch, abdominal oblique crunch and latissimus pull.

- O detalhamento do treino é confuso

Combined endurance/resistance training early on, after a first myocardial infarction, does not induce negative left ventricular remodelling

Schmid, J.P et al., Eur J of Cardiol Prev and Rehab,15:341–346: 2008



Combined endurance/resistance training early on, after a first myocardial infarction, does not induce negative left ventricular remodelling

Schmid, J.P et al., Eur J of Cardiol Prev and Rehab,15:341–346: 2008

Table 3 Parameters of left ventricular remodelling at baseline and after the training programme at 3 and 12 months, as measured by magnetic resonance imaging

	ET/RT ($n=17$)			ET ($n=21$)		
	Baseline	3 months	12 months	Baseline	3 months	12 months
EF, %	49.1±12.3	49.6±14.4	49.3±12.0	51.5±13.1	53.7±12.7	54.1±11.8
EDV, ml	206±41	210±46	210±48	183±43	194±36*	186±52
ESV, ml	108±43	110±48	111±49	91±38	93±43	89±44
SV, ml	98±17	100±21	99±14	92±28	101±27*	97±21
LV mass, g	149±28	150±26	155±31	144±36	144±32	149±42

EDV, end-diastolic volume; EF, ejection fraction; ESV, end-systolic volume; LV, left ventricular; SV, stroke volume. *$P<0.05$, intragroup vs. baseline. No statistically significant difference was noted between the groups at baseline, or with respect to changes over time.

Combined endurance/resistance training early on, after a first myocardial infarction, does not induce negative left ventricular remodelling

Schmid, J.P et al., Eur J of Cardiol Prev and Rehab,15:341–346: 2008

- Tanto aeróbio quanto combinado melhoram a capacidade funcional, o consumo de oxigênio e força após 3 meses.

- A capacidade funcional e força ainda perduram em relação ao pré após 9 meses no grupo combinado.

- Não houve remodelação do miocárdio com o treinamento físico.

EFFECT OF AEROBIC VS COMBINED AEROBIC-STRENGTH TRAINING ON 1-YEAR, POST-CARDIAC REHABILITATION OUTCOMES IN WOMEN AFTER A CARDIAC EVENT

Heather, M et al, J Rehabil Med 2007; 39: 730–735

- 92 Mulheres com infarto agudo do miocárdio

- Randomizadas em grupo aeróbio e combinado

- Qualidade de vida, auto-percepção, força e VO_2

- Pre, 2 meses, 6 meses e 18 meses.

EFFECT OF AEROBIC VS COMBINED AEROBIC-STRENGTH TRAINING ON 1-YEAR, POST-CARDIAC REHABILITATION OUTCOMES IN WOMEN AFTER A CARDIAC EVENT

Heather, M et al, J Rehabil Med 2007; 39: 730–735

- Ambos os grupos realizaram treino aeróbio antes de serem randomizados (2x semana por 2 meses)

- ***Grupo aeróbio*** **(2 x semana, 6 meses)**

- **Aquecimento (10 a 15 min)**

- **Exercício intervalado (bicicleta, esteira, ergômetro de braço)**

- **Intensidade (40 a 70% da capacidade funcional)**

Effects of Different Types of Exercise Training Followed by Detraining on Endothelium-Dependent Dilation in Patients With Recent Myocardial Infarction

Vona, M et al., Circulation;119:1601-1608:2009

- Pacientes com histórico recente de infarto com potência aeróbia acima de 75 watts

- Sem hipertrofia ventricular

- Fração de ejeção acima de 45%

- Capacidade funcional e função endotelial (pré e após 4 semanas.

Effects of Different Types of Exercise Training Followed by Detraining on Endothelium-Dependent Dilation in Patients With Recent Myocardial Infarction

Vona, M et al., Circulation;119:1601-1608:2009

Randomizados

- 58 pacientes - aeróbio - G1

- 57 pacientes - treinamento de força - G2

- 57 pacientes - treinamento aeróbio + força - G3

- 57 pacientes - controle - G4

Effects of Different Types of Exercise Training Followed by Detraining on Endothelium-Dependent Dilation in Patients With Recent Myocardial Infarction

Vona, M et al., Circulation. 2009;119:1601-1608

G1 - Aeróbio

- 4 x na semana - bicicleta (4 semanas)

- 10 min aquecimento

- 40 min a 75% da FC máx

- 10 min de alongamento

Effects of Different Types of Exercise Training Followed by Detraining on Endothelium-Dependent Dilation in Patients With Recent Myocardial Infarction

Vona, M et al., Circulation. 2009;119:1601-1608

G2 - Treinamento de força

- 4 x na semana (4 semanas)
- 4 séries de 10 exercícios (10 a 12 repetições)
- 60 % da CVM
- 15 a 30 seg de recuperação
- Aquecimento e alongamento

Effects of Different Types of Exercise Training Followed by Detraining on Endothelium-Dependent Dilation in Patients With Recent Myocardial Infarction

Vona, M et al., Circulation. 2009;119:1601-1608

G3 - Treinamento de força e aeróbio

- 4 x na semana (4 semanas)

- 2 sessões aeróbio

- 2 sessões de força

G4 - Controle

- Sem exercício

Effects of Different Types of Exercise Training Followed by Detraining on Endothelium-Dependent Dilation in Patients With Recent Myocardial Infarction

Vona, M et al., Circulation. 2009;119:1601-1608

Table 2. Metabolic Parameters at Baseline and Follow-Up

	G1, Aerobic Training (n=52)		G2, Resistance Training (n=54)		G3, Combined Training (n=53)		G4, Control (n=50)	
	Time 0	Follow-Up (1 mo)	Time 0	Follow-Up (1 mo)	Time 0	Follow-Up (1 mo)	Time 0	Follow-Up (1 mo)
Total cholesterol, mg/dL	161±18	163±22	159±24	163±21	166±25	158±25	160±13	165±19
HDL cholesterol, mg/dL	48±12	49±8	47±10	45±14	46±12	48±10	46±7	47±9
LDL cholesterol, mg/dL	94±12	95±15	92±18	91±20	93±16	95±10	94±8	96±12
Triglycerides, mg/dL	142±59	154±34	144±66	140±44	144±57	151±39	139±40	145±37
Glycemia, mg/dL	89±9.3	92±8.2	84±11.3	85±8.2	81±10.5	87±12	87±7	90±9.9
Body mass index, kg/m^2	26.5±2.4	27±3.1	25.9±2.8	26.3±3.2	26.3±2.5	25.9±3.3	25.7±3.4	26.2±3.8

HDL indicates high-density lipoprotein; LDL, low-density lipoprotein.

Effects of Different Types of Exercise Training Followed by Detraining on Endothelium-Dependent Dilation in Patients With Recent Myocardial Infarction

Vona, M et al., Circulation. 2009;119:1601-1608

Table 3. Ergometric Parameters During Exercise Testing at Baseline and Follow-Up

	G1, Aerobic Training (n=52)		G2, Resistance Training (n=54)		G3, Combined Training (n=53)		G4, Control (n=50)	
	Time 0	Follow-Up (1 mo)	Time 0	Follow-Up (1 mo)	Time 0	Follow-Up (1 mo)	Time 0	Follow-Up (1 mo)
Heart rate, bpm	132±8	128±9	129±9	132±7	129±9	132±7	127±8	135±9
Blood pressure, mm Hg	178±14	182±18	185±19	180±22	177±23	186±24	183±17	188±25
Time, min	13.4±2.7	18±2.9*	13.2±2	17.6±2.5*	12.9±2.7	18.3±2.5*	13.4±2.7	14.2±3.7
Peak Vo_2, mL · kg^{-1} · min^{-1}	22.0±1.2	25.7±1.6*	22.4±1.2	25.9±1.4*	21.7±1.5	26.2±1.6*	22.3±1.3	22.8±1.6

*$P<0.01$.

Effects of Different Types of Exercise Training Followed by Detraining on Endothelium-Dependent Dilation in Patients With Recent Myocardial Infarction

Vona, M et al., Circulation. 2009;119:1601-1608

Table 4. Brachial Reactivity Results at Baseline and Follow-Up

	G1, Aerobic Training (n=52)			G2, Resistance Training (n=54)			G3, Combined Training (n=53)			G4, Control (n=50)		
	Baseline	Follow-Up (1 mo)	DT	Baseline	Follow-Up (1 mo)	DT	Baseline	Follow-Up (1 mo)	DT	Baseline	Follow-Up (1 mo)	DT
Baseline diameter, mm	4.2±0.66	4.1±0.57	4.1±0.62	4.1±0.58	4.2±0.7	4.1±0.52	4.05±0.4	4.1±0.7	4.0±0.6	4.2±0.6	4.1±0.7	4.1±0.6
FMD%	4.5±2.6	9.9±2.5*	4.7±1.6*	4.01±1.6	10.1±2.6*	4.8±1.8*	4.4±4	10.8±3*	4.7±2.5*	4.3±2.3	5.1±2.5†	5.3±2.8
NGT%	14.1±5.3	13.5±4.1	13.6±3.9	13.8±3.6	13.9±4.2	14.1±5.1	13.6±4.7	12.9±5.6	14.2±3.7	13.1±4.6	12.9±5.2	13.7±5.8

DT indicates detraining; FMD%, percent change after FMD; and NGT%, percent change in arterial diameter after the nitroglycerin test.

Effects of Different Types of Exercise Training Followed by Detraining on Endothelium-Dependent Dilation in Patients With Recent Myocardial Infarction

Vona, M et al., Circulation. 2009;119:1601-1608

- A capacidade funcional aumenta independentemente do tipo de exercício (aeróbio, força ou combinado em pacientes com DAC.

- A função endotelial aumenta independentemente do tipo de exercício (aeróbio, força ou combinado em pacientes com DAC.

- Contudo, o destreino promove retorno dos valores pré-treinamento.

Exercise prescription in primary and secondary coronary prevention
Reproduced from Lavie et al[2]

Mode
Aerobic exercise: walking, jogging, cycling, swimming, rowing, stair climbing, elliptical trainers, aerobic dance
Resistance training: hand weights, elastic bands, weight machines, calisthenics
Duration
Aerobic exercise: at least 20-30 min (preferably 45-60 min)
Resistance training: 10-15 repetitions; 1-3 sets of 8-10 different exercises for both upper and lower extremities
Frequency
Aerobic exercise: most days (at least 5/wk and preferably 6-7 d)
Resistance training: 2-3 sessions/wk (nonconsecutive days)
Intensity
Aerobic exercise: 50%-75% of peak VO_2 or close to anaerobic threshold, or 65%-85% of maximal heart rate; 10-15 beats/min below the level of exercise-induced ischemia
Resistance training: moderate intensity (should not be straining on last repetitions)

Lavie & Milani, Progress in Cardiovascular Diseases (2011)

Quanto meu aluno com CAD deve melhorar com o programa de exercício???

Benefits of CRET programs
Improvement in exercise capacity
Estimated METS, +35%
Peak VO_2, +15%
Peak anaerobic threshold, +11%
Reduction in obesity indices
Body mass index, −1.5%
Percent fat, −5%
MS, −37%
Improvements in lipids
Total cholesterol, −5%
Triglycerides, −15%
HDL-C, +6% (+13% to +16% increase in subgroups with low HDL-C levels)
LDL-C, −2%
LDL-C/HDL-C, −5% (higher in some subgroups)
Reduction in inflammation (hs-CRP, 40%)
Improvements in behavioral characteristics (depression, anxiety, somatization, and hostility)
Improvement in autonomic tone
Improvement in blood rheology and viscosity
Reduction in homocysteine levels
Improvements in overall quality of life and its components
Reduction in hospitalization costs
Reduction in overall morbidity and mortality (especially that associated with depression and psychological distress)

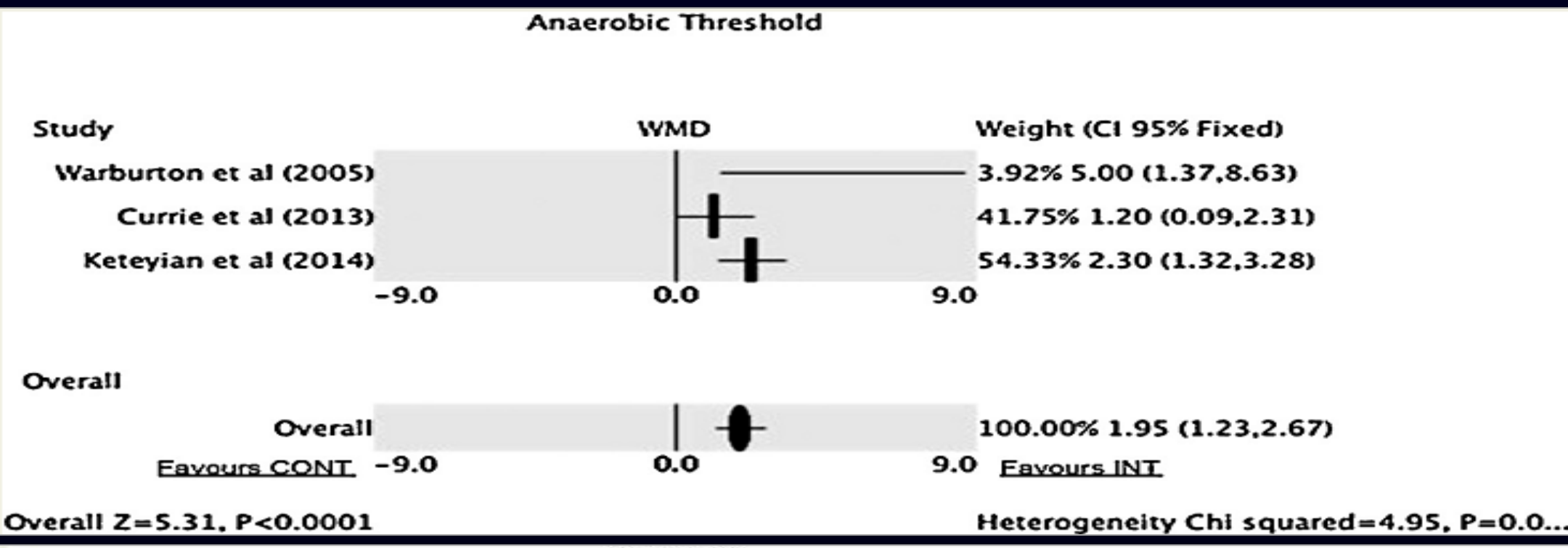
HOT TOPIC

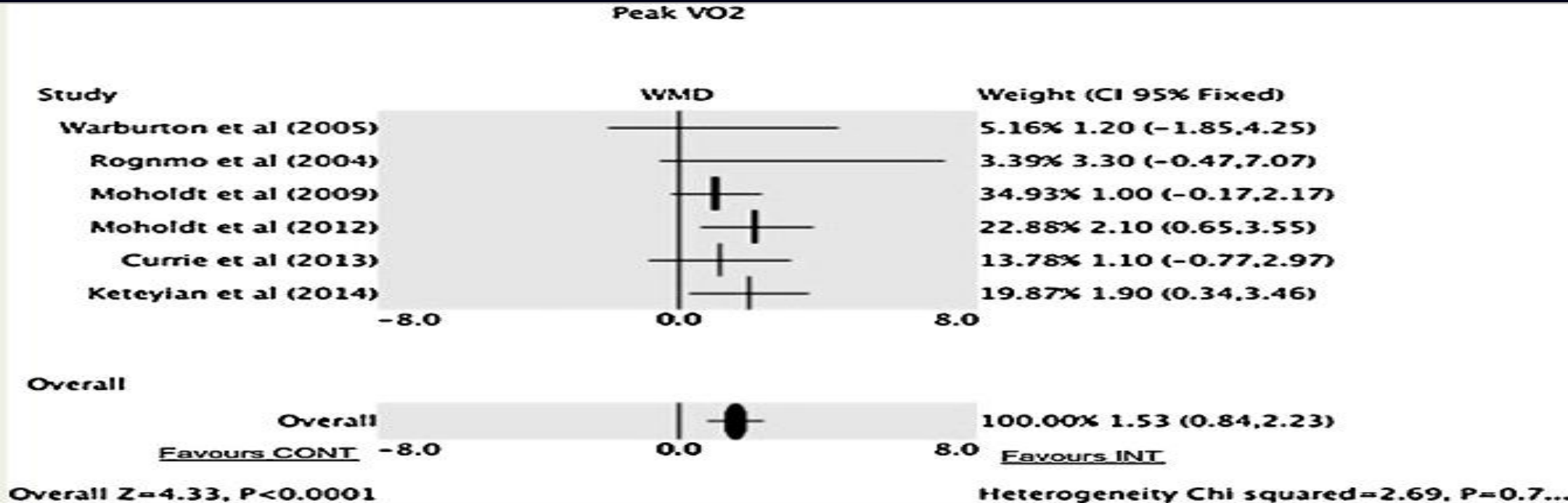
Heart, Lung and Circulation (2014) xx, 1–9
1443-9506/04/$36.00
http://dx.doi.org/10.1016/j.hlc.2014.09.001

ORIGINAL ARTICLE

Interval Training Versus Continuous Exercise in Patients with Coronary Artery Disease: A Meta-Analysis

Adrian D. Elliott, Ph.D [a,b*], Kanchani Rajopadhyaya, Ph.D [c], David J. Bentley, Ph.D [a], John F. Beltrame, MBBS, Ph.D [c], Edoardo C. Aromataris, Ph.D [b]


Anaerobic Threshold
Study
WMD
Weight (CI 95% Fixed)
Warburton et al (2005)
3.92% 5.00 (1.37,8.63)
Currie et al (2013)
41.75% 1.20 (0.09,2.31)
Keteyian et al (2014)
54.33% 2.30 (1.32,3.28)
-9.0
0.0
9.0
Overall
Overall
100.00% 1.95 (1.23,2.67)
Favours CONT
-9.0
0.0
9.0
Favours INT
Overall Z=5.31, P<0.0001
Heterogeneity Chi squared=4.95, P=0.0...


Peak VO2
Study
WMD
Weight (CI 95% Fixed)
Warburton et al (2005)
5.16% 1.20 (-1.85,4.25)
Rognmo et al (2004)
3.39% 3.30 (-0.47,7.07)
Moholdt et al (2009)
34.93% 1.00 (-0.17,2.17)
Moholdt et al (2012)
22.88% 2.10 (0.65,3.55)
Currie et al (2013)
13.78% 1.10 (-0.77,2.97)
Keteyian et al (2014)
19.87% 1.90 (0.34,3.46)
-8.0
0.0
8.0
Overall
Overall
100.00% 1.53 (0.84,2.23)
Favours CONT
-8.0
0.0
8.0
Favours INT
Overall Z=4.33, P<0.0001
Heterogeneity Chi squared=2.69, P=0.7...

CASO CLÍNICO

Data de nascimento: 07/11/1947 Uso de medicação que influencia na freqüência cardíaca: não. Protocolo: Balke modificado.

Tempo	Estágio	FC	PAS	PAD	VO_2	VE	VE/VO_2	RQ	$PetO_2$	$PetCO_2$	VE/VCO_2
Rep	-	68	120	68	3,5	9	39	0,68	101	38	37
00:30	1	82			5,3	18	38	0,72	97	42	36
01:00	1	90			8,5	21	36	0,74	96	43	36
01:30	2	98	142	78	9,2	24	35	0,78	96	43	35
02:00	2	104			11,6	27	35	0,81	94	44	34
02:30	3	114			12,0	30	34	0,84	93	44	33
03:00	3	125			14,1	33	33	0,87	92	45	32
03:30	4	130	162	88	14,7	37	32	0,89	91	45	33
04:00	4	137			17,1	40	32	0,92	91	46	32
04:30	5	140			18,0	46	32	0,94	90	46	32
05:00	5	149			21,8	50	35	0,99	95	47	33
05:30	6	154	176	88	22,0	53	38	1,01	100	47	32
06:00	6	164			27,3	63	40	1,04	106	43	38
06:30	7	178			28,2	66	42	1,15	112	41	40
07:00	7	180			30,0	68	43	1,16	113	40	41
Rec	-	150			17,4	55	37	1,25	102	39	37

Laudo: Razão para o teste: Avaliação cardiorrespiratória para início de programa de exercício

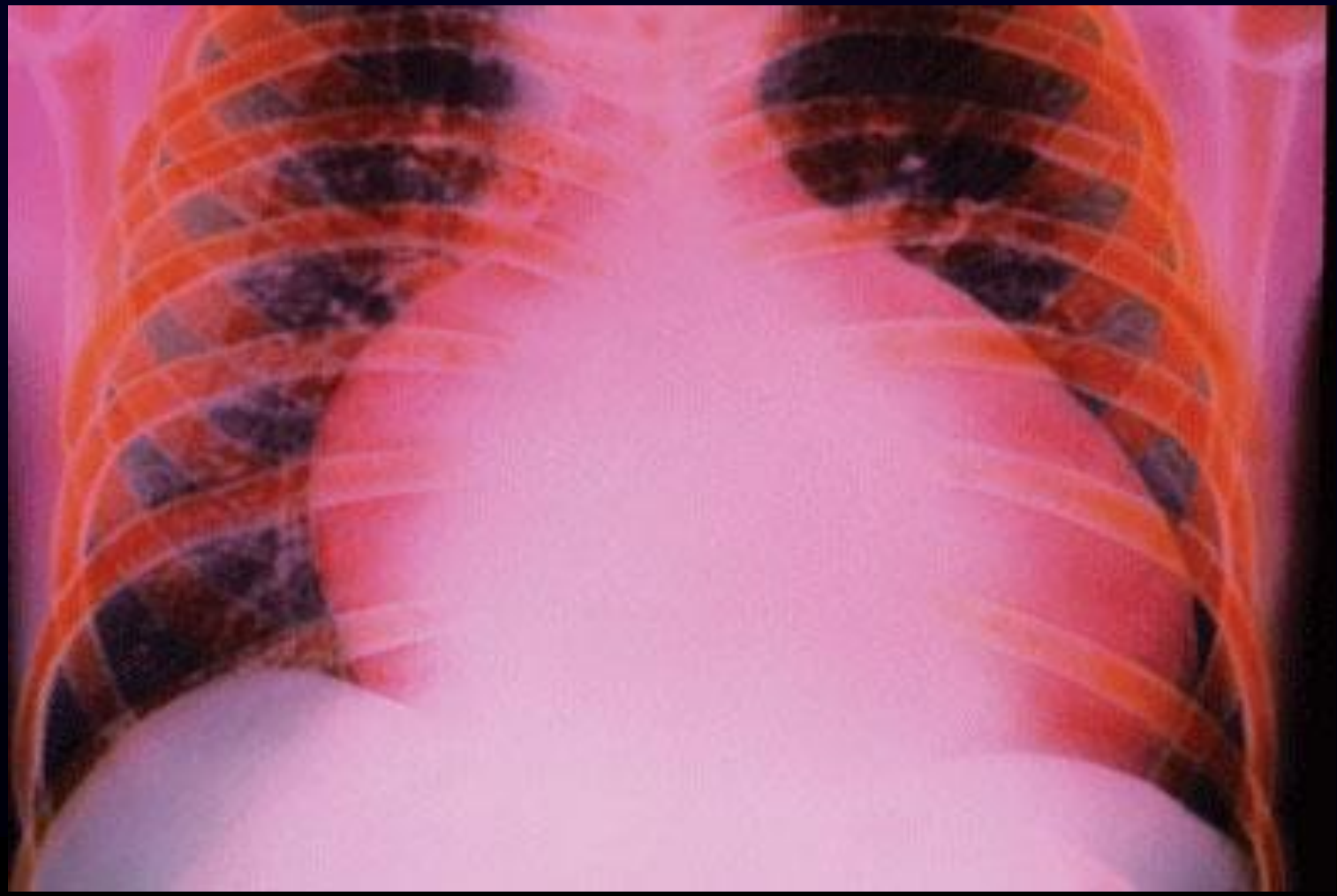
Motivo de interrupção do teste: Cansaço físico

Eletrocardiograma de repouso: Ritmo sinusal traçado dentro da normalidade

Respostas eletrocardiográficas durante o teste: Foram observadas alterações no segmento ST sugestivo de isquemia miocárdica (aos 122 bpm). Não foram observadas alterações importantes no ritmo cardíaco durante o esforço e na recuperação.

Conclusões: Teste positivo para isquemia miocárdica

INSUFICIÊNCIA CARDÍACA



Continuum Cardiovascular

INSUFICIÊNCIA CARDÍACA

É a incapacidade do coração em adequar sua ejeção às necessidades metabólicas do organismo, ou fazê-la somente através de elevadas pressões de enchimento.

CLASSIFICAÇÃO FUNCIONAL DA INSUFICIÊNCIA CARDÍACA

CLASSE I	*Assintomáticos em atividades habituais*
CLASSE II	*Assintomático em repouso. Sintomas nas atividades habituais*
CLASSE III	*Assintomático em repouso. Sintomas nas atividades menores que as habituais*
CLASSE IV	*Sintomas em repouso exacerbados pelas menores atividades*

CONSEQUÊNCIAS DA INSUFICIÊNCIA CARDÍACA

REDUÇÃO DA FRAÇAO DE EJEÇÃO

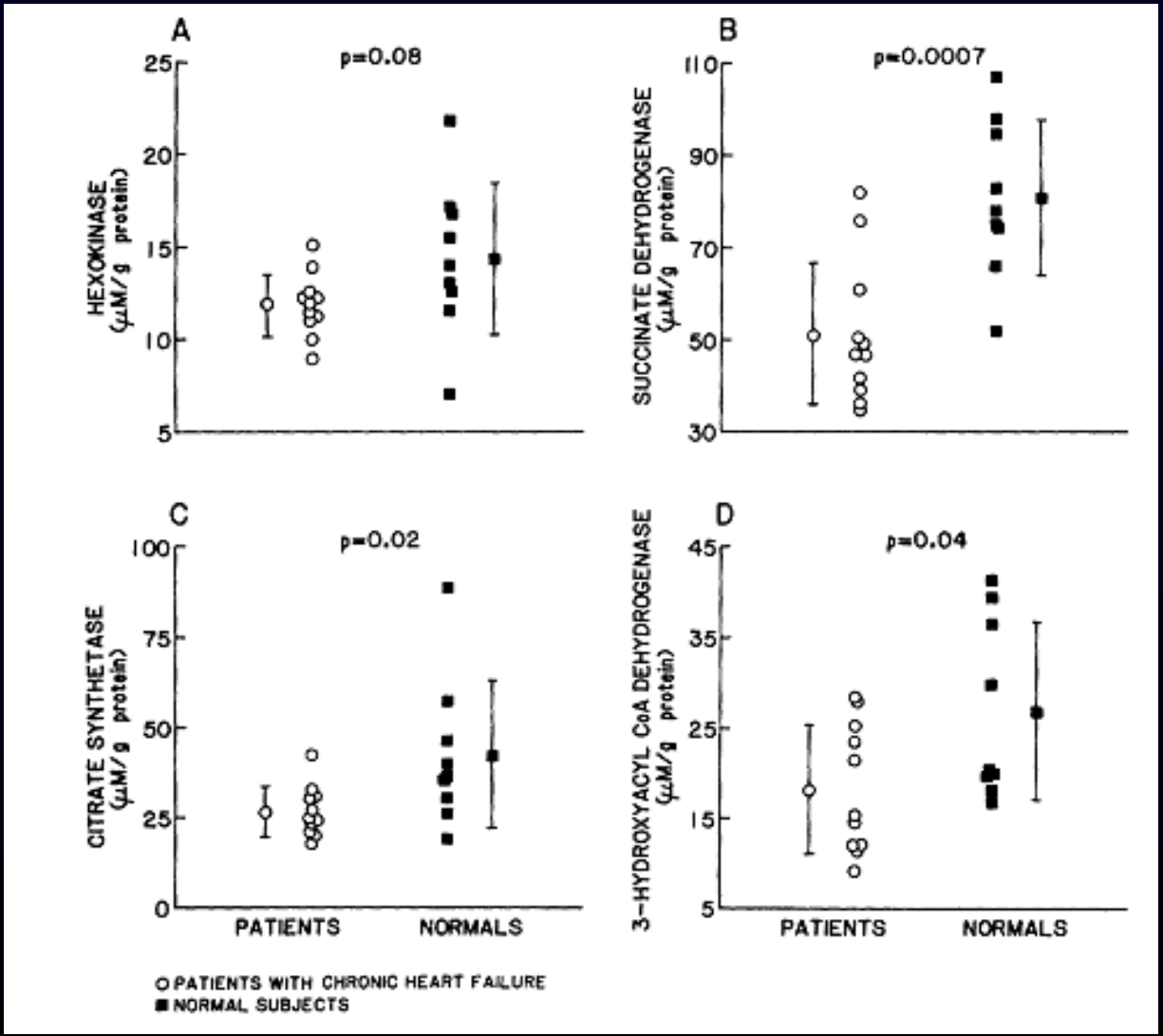
TABLE 1. Demographics, Resting Left Ventricular Ejection Fraction, and Peak Oxygen Consumption in 11 Patients and Nine Normal Subjects

	Age (yr)	WT (kg)	BSA (m^2)	LVEF (%)	Peak $\dot{V}O_2$ (ml/kg/min)
Patients with heart failure					
1	59	70	1.82	21	15.4
2	41	60	1.70	25	14.8
3	66	62	1.68	16	12.2
4	42	86	2.06	13	8.1
5	71	62	1.72	32	10.4
6	70	93	2.09	16	14.2
7	62	72	1.82	27	20.5
8	65	60	1.66	36	13.1
9	35	52	1.61	10	12.4
10	65	72	1.83	16	10.7
11	69	70	1.73	22	10.7
Mean	58	69	1.79	21	13.0
SD	13	12	0.16	8	3.3
Normal subjects					
1	34	67	1.80	73	43.2
2	30	75	1.96	77	32.9
3	42	73	1.79	59	25.8
4	48	86	2.10	69	40.3
5	55	72	1.91	. . .	36.8
6	54	82	1.88	59	18.7
7	51	82	1.94	55	27.8
8	55	73	1.81	55	21.0
9	70	81	1.95	67	25.1
Mean	49	76	1.92	64	30.2
SD	12	6	0.19	8	8.6
p	0.10	0.10	0.09	<0.001	<0.001

WT, body weight; BSA, body surface area; LVEF, radionuclide left ventricular ejection fraction; Peak $\dot{V}O_2$, peak exercise oxygen consumption.

Sullivan, M.J. et al. Circulation 1990;81:518-527

REDUÇÃO DA CAPACIDADE OXIDATIVA



Sullivan, M.J. et al. Circulation 1990;81:518-527

COMPOSIÇÃO DAS FIBRAS MUSCULARES

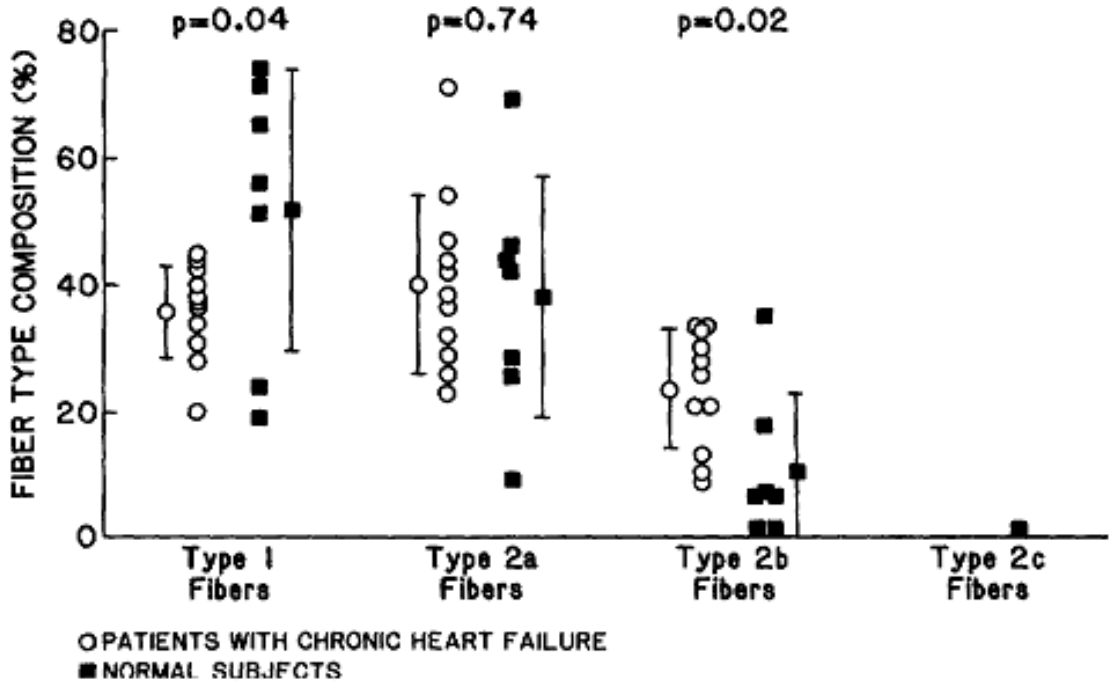


FIGURE 3. *Graphic plotting of relative fiber type composition of the vastus lateralis in patients with long-term heart failure and in normal subjects, in mixed skeletal muscle samples in patients with long-term heart failure and in normal subjects.*

Sullivan, M.J. et al. Circulation 1990;81:518-527

EFEITOS AGUDOS DO EXERCÍCIO NA INSUFICIÊNCIA CARDÍACA

Comparison of Hemodynamic Responses to Cycling and Resistance Exercise in Congestive Heart Failure Secondary to Ischemic Cardiomyopathy

Mckelvie, R.S. et al., Am J. Cardio, 76, 1995

- 10 pacientes com IC (homens)
- 5 minutos de bicicleta a 70% da FC pico
- 2 séries de leg press a 70% de 1 RM
- PA (direta)
- Eletrocardiograma

Comparison of Hemodynamic Responses to Cycling and Resistance Exercise in Congestive Heart Failure Secondary to Ischemic Cardiomyopathy

Mckelvie, R.S. et al., Am J. Cardio, 76, 1995

TABLE I Changes in Systolic and Diastolic Blood Pressure, Heart Rate, Rate-Pressure Product, and End-Diastolic and End-Systolic Volumes During Cycling and Leg Press Exercises

	Rest	Leg Press	Cycling
Systolic blood pressure (mm Hg)	157 ± 7	189 ± 8*	199 ± 13*†
Diastolic blood pressure (mm Hg)	77 ± 2	98 ± 4*	86 ± 3*†
Heart rate (beats/min)	66 ± 4	86 ± 5*	107 ± 4*†
Rate-pressure product	103 ± 6	161 ± 7*	213 ± 17*†
End-diastolic volume (ml)	257 ± 26	269 ± 27	268 ± 24
End-systolic volume (ml)	179 ± 22	188 ± 22	180 ± 23

*p <0.05 compared with rest; †p <0.05 compared with leg press.
Values are expressed as mean ± SEM.

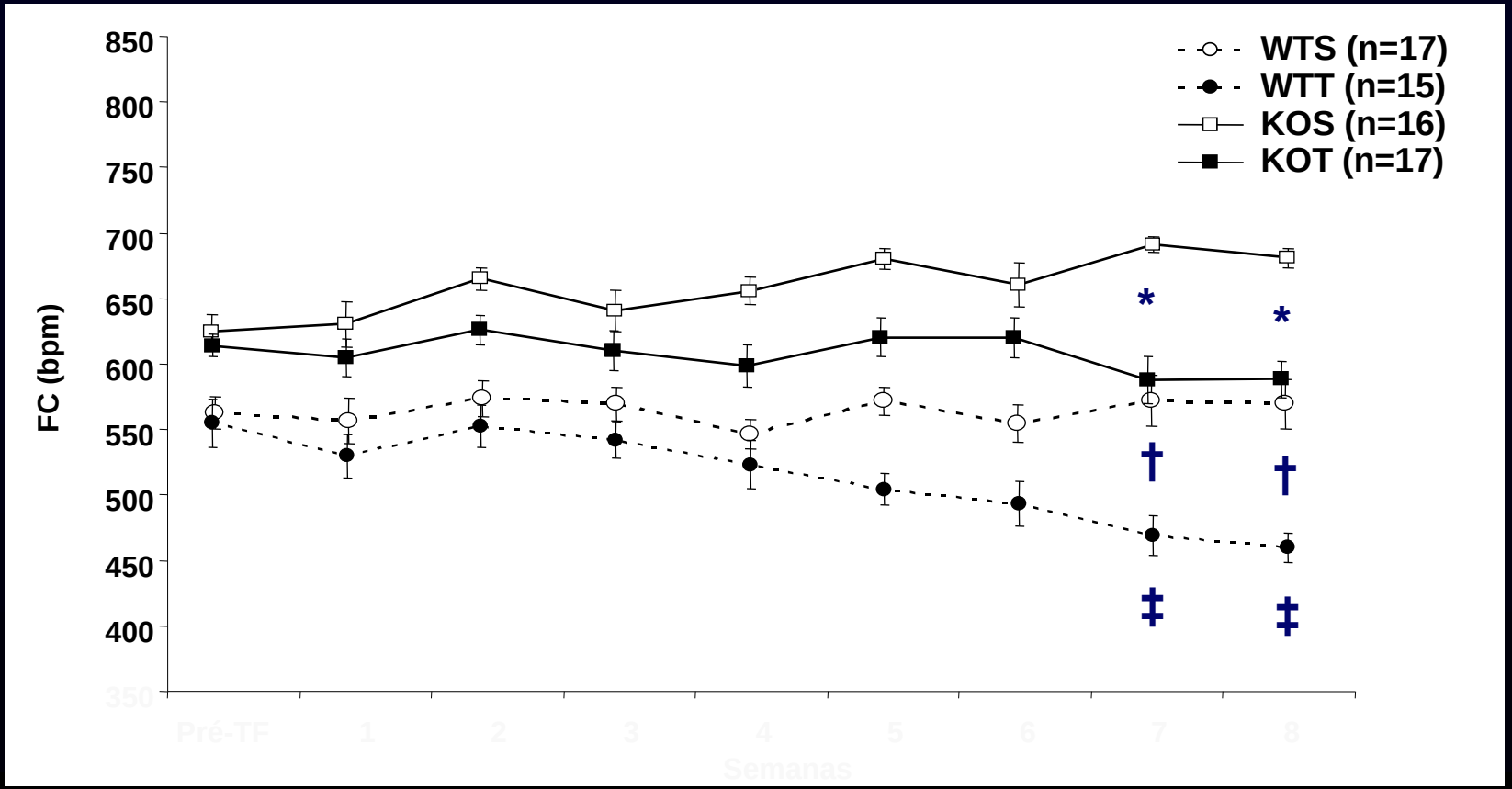
TABLE II Changes in Cardiac Output, Stroke Volume, Total Peripheral Resistance, Ejection Fraction, and Systolic Blood Pressure to End-Systolic Volume Ratio During Cycling and Leg Press Exercises

	Rest	Leg Press	Cycling
Cardiac output (L/min)	5.2 ± 0.5	6.9 ± 0.5*	9.3 ± 0.7*†
Stroke volume (ml)	77 ± 5	80 ± 4	87 ± 5*†
Total peripheral resistance (mm Hg•L^{-1}•min^{-1})	23 ± 2	20 ± 2	14 ± 1*†
Ejection fraction (%)	31 ± 2	32 ± 2	34 ± 2
Systolic BP/ESV ratio	0.9 ± 0.1	1.1 ± 0.1*	1.2 ± 0.2*†

*p <0.05 compared with rest; †p <0.05 compared with leg press.
Values are expressed as mean ± SEM.
BP = blood pressure; ESV = end-systolic volume.

EFEITOS CRÔNICOS DO TREINAMENTO FÍSICO

TREINAMENTO FÍSICO NA INSUFICIENCIA CARDÍACA

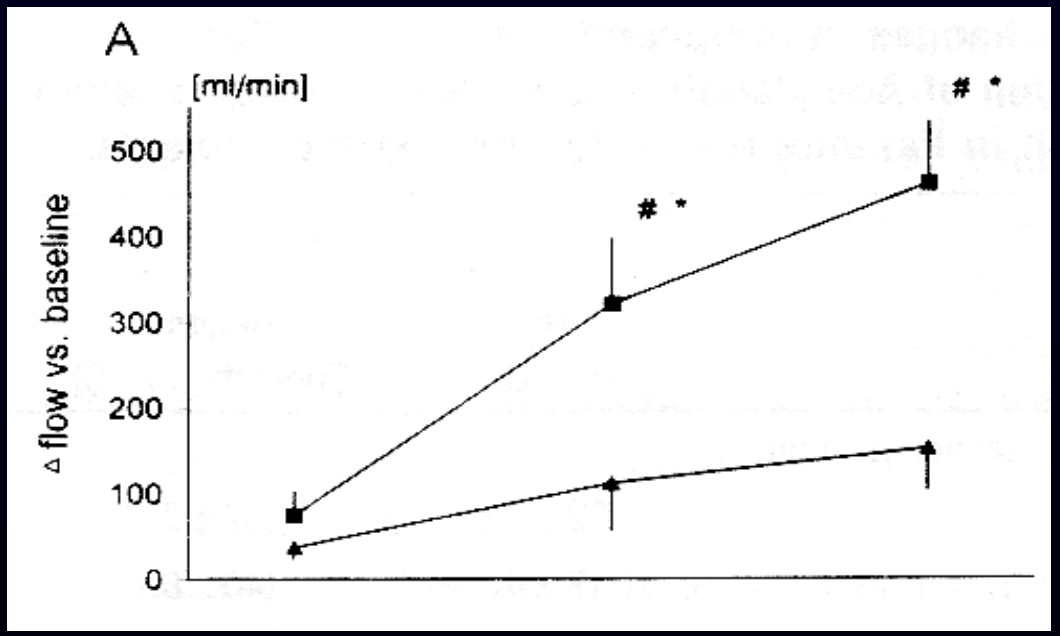


† KOS vs. KOT ($p<0.05$)

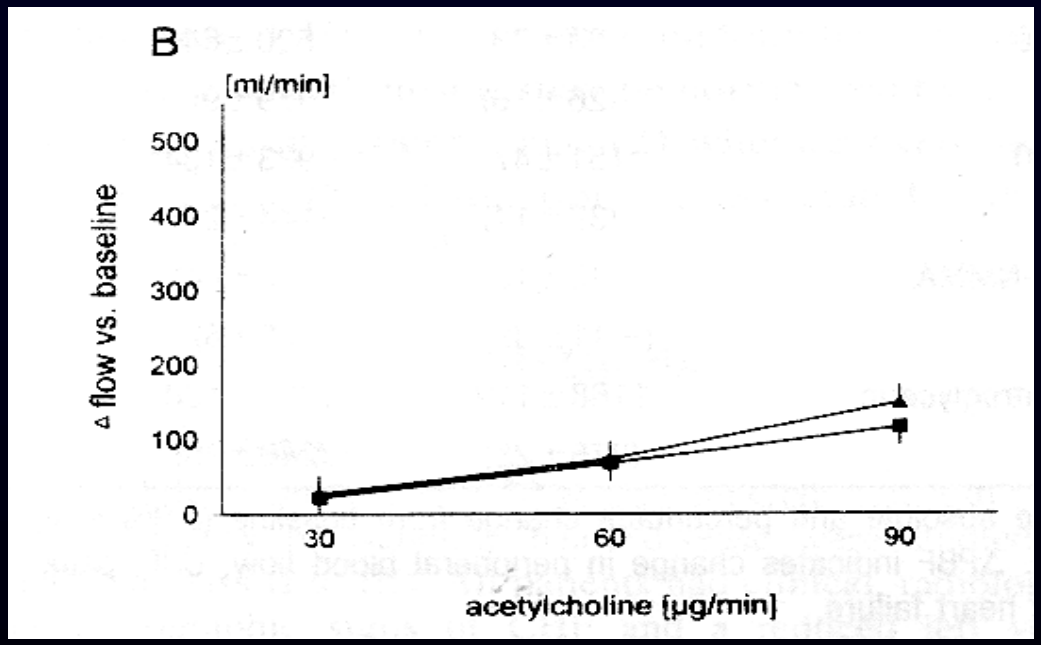
Rolim, NPL et al. *Physiological Genomics*, 2007

TREINAMENTO FÍSICO NA INSUFICIENCIA CARDÍACA

TF, 6 meses, 40 min, 5x/sem, 70% VO_2 max



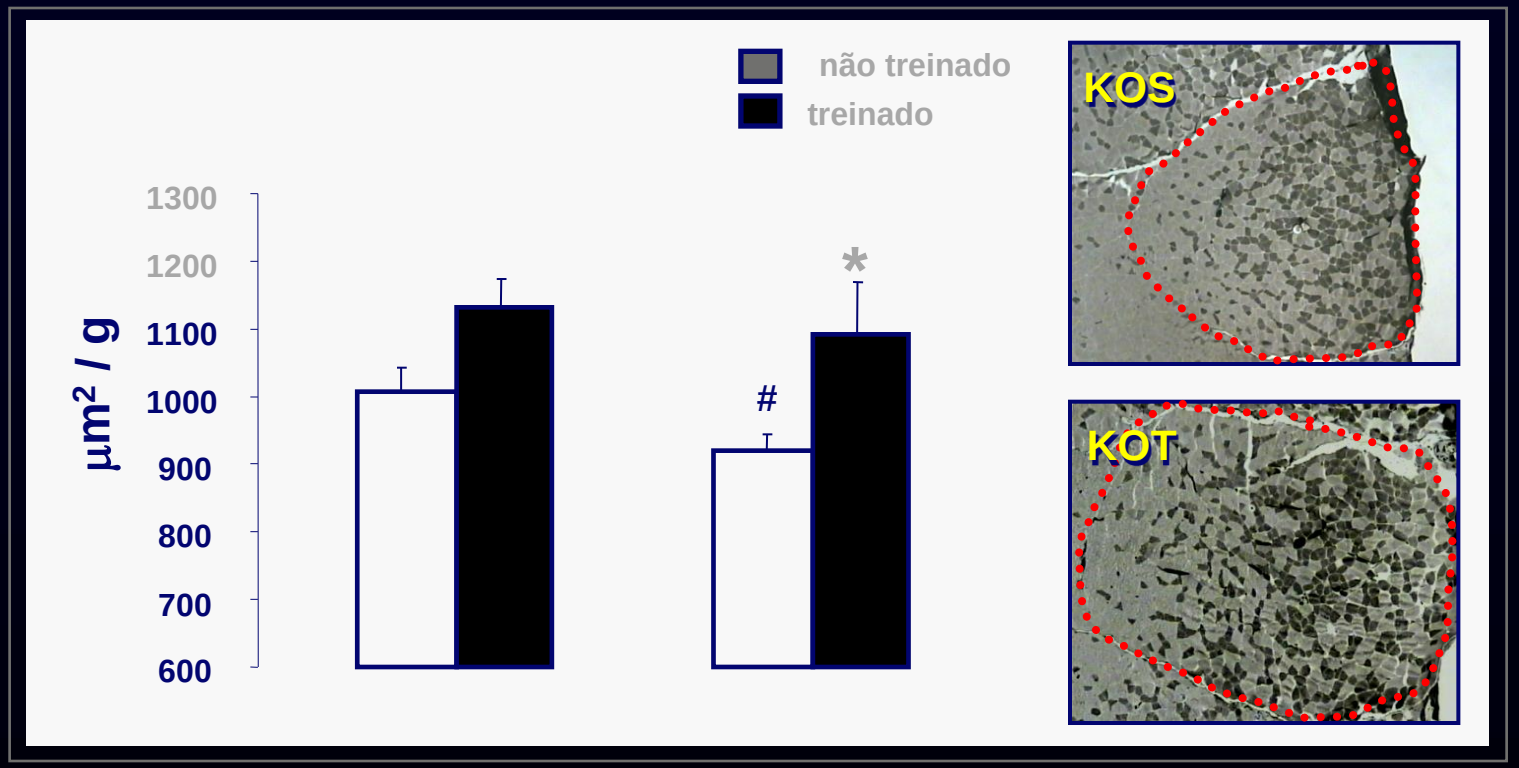
ICC-Treinados



ICC-Sedentários

Hambrecht R. et al. *Circulation* 98:2709-2715, 1998

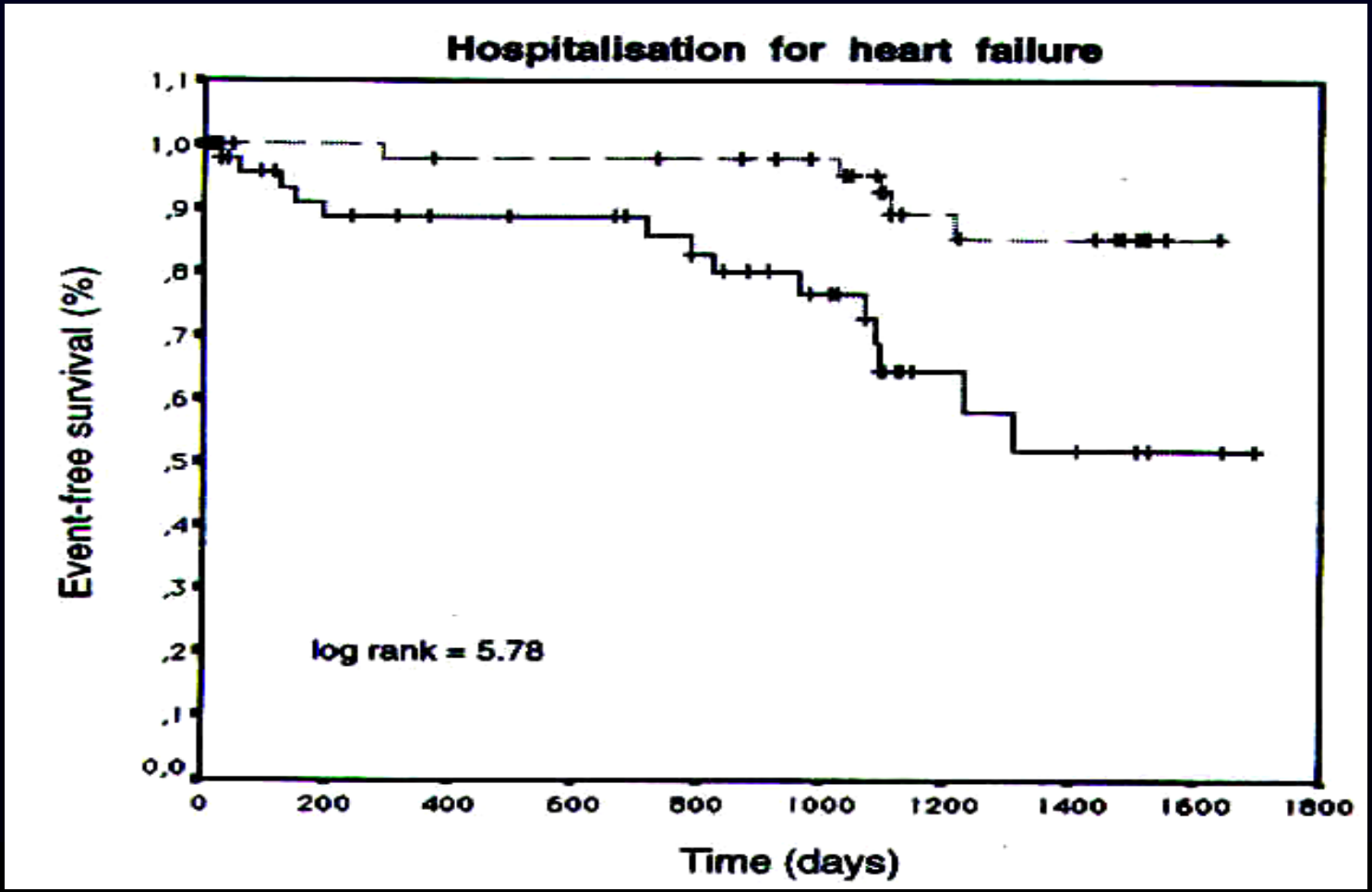
TREINAMENTO FÍSICO NA INSUFICIENCIA CARDÍACA



 # *vs.* WT não treinado.

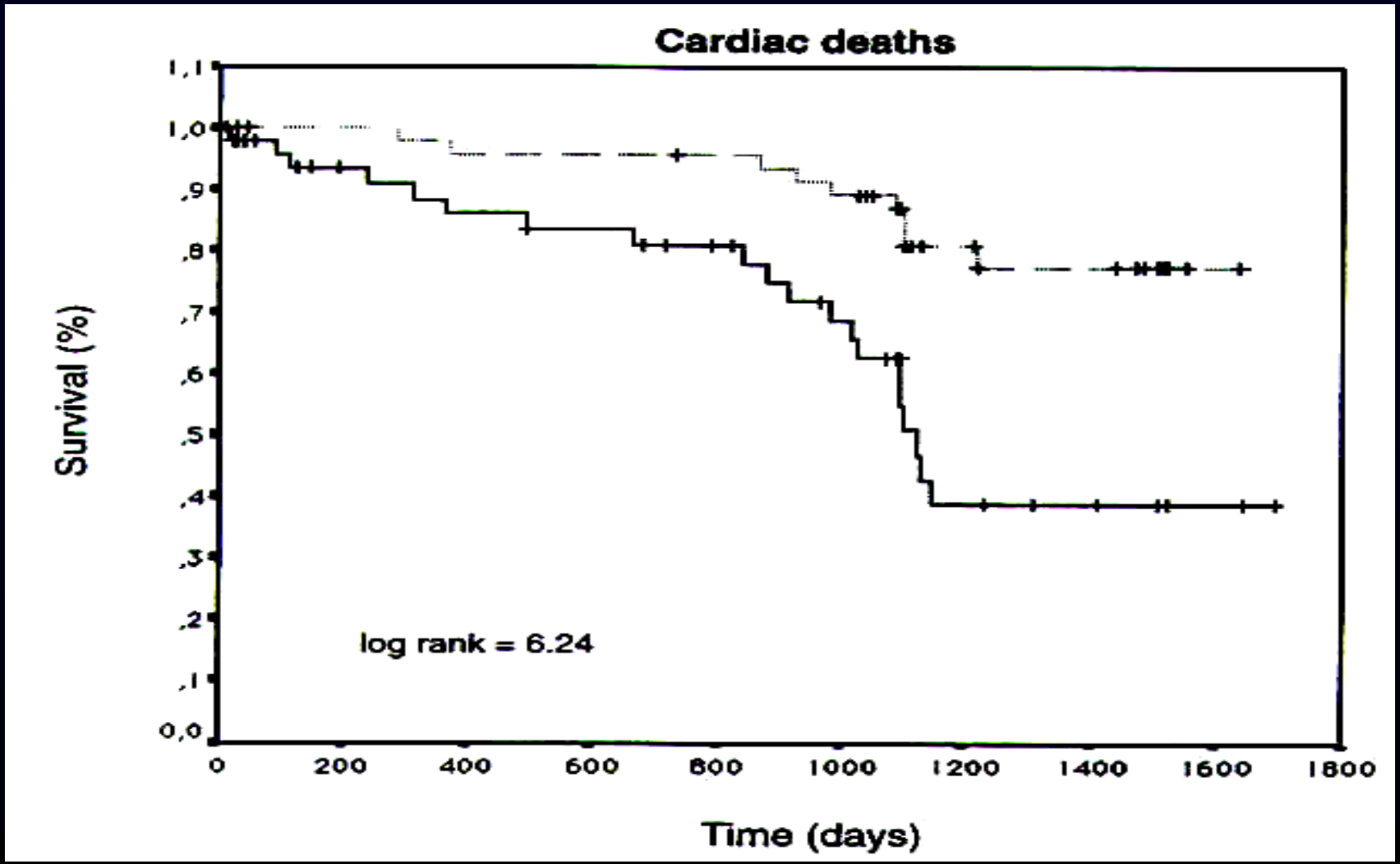
*** *vs.* treinado.**

TREINAMENTO FÍSICO NA INSUFICIENCIA CARDÍACA



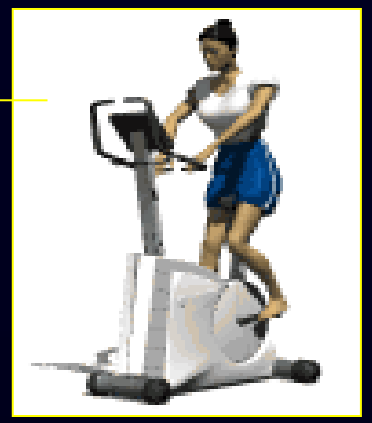
Belardinelli R. et al. *Circulation* 99: 1173-1182, 1999

TREINAMENTO FÍSICO NA INSUFICIENCIA CARDÍACA



Belardinelli R. et al. *Circulation* 99: 1173-1182, 1999

↓ Atividade nervosa simpática

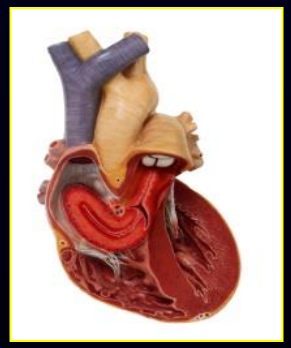


↓ Vasoconstrição

↑ Fluxo Vascular Periférico

↓ Pós Carga

↓ Citocinas
Espécies Reativas de O2



↑ Volume Sistólico
Débito Cardíaco

↑ Função Endotelial
+ vasodilatação

Melhora da modulação de Cálcio celular

↑ CAPACIDADE FUNCIONAL

Exercise Physiology

Superior Cardiovascular Effect of Aerobic Interval Training Versus Moderate Continuous Training in Heart Failure Patients

A Randomized Study

Ulrik Wisløff, PhD; Asbjørn Støylen, MD, PhD; Jan P. Loennechen, MD, PhD; Morten Bruvold, MSc; Øivind Rognmo, MSc; Per Magnus Haram, MD, PhD; Arnt Erik Tjønna, MSc; Jan Helgerud, PhD; Stig A. Slørdahl, MD, PhD; Sang Jun Lee, PhD; Vibeke Videm, MD, PhD; Anja Bye, MSc; Godfrey L. Smith, PhD; Sonia M. Najjar, PhD; Øyvind Ellingsen, MD, PhD; Terje Skjærpe, MD, PhD

TREINAMENTO FÍSICO NA INSUFICIENCIA CARDÍACA

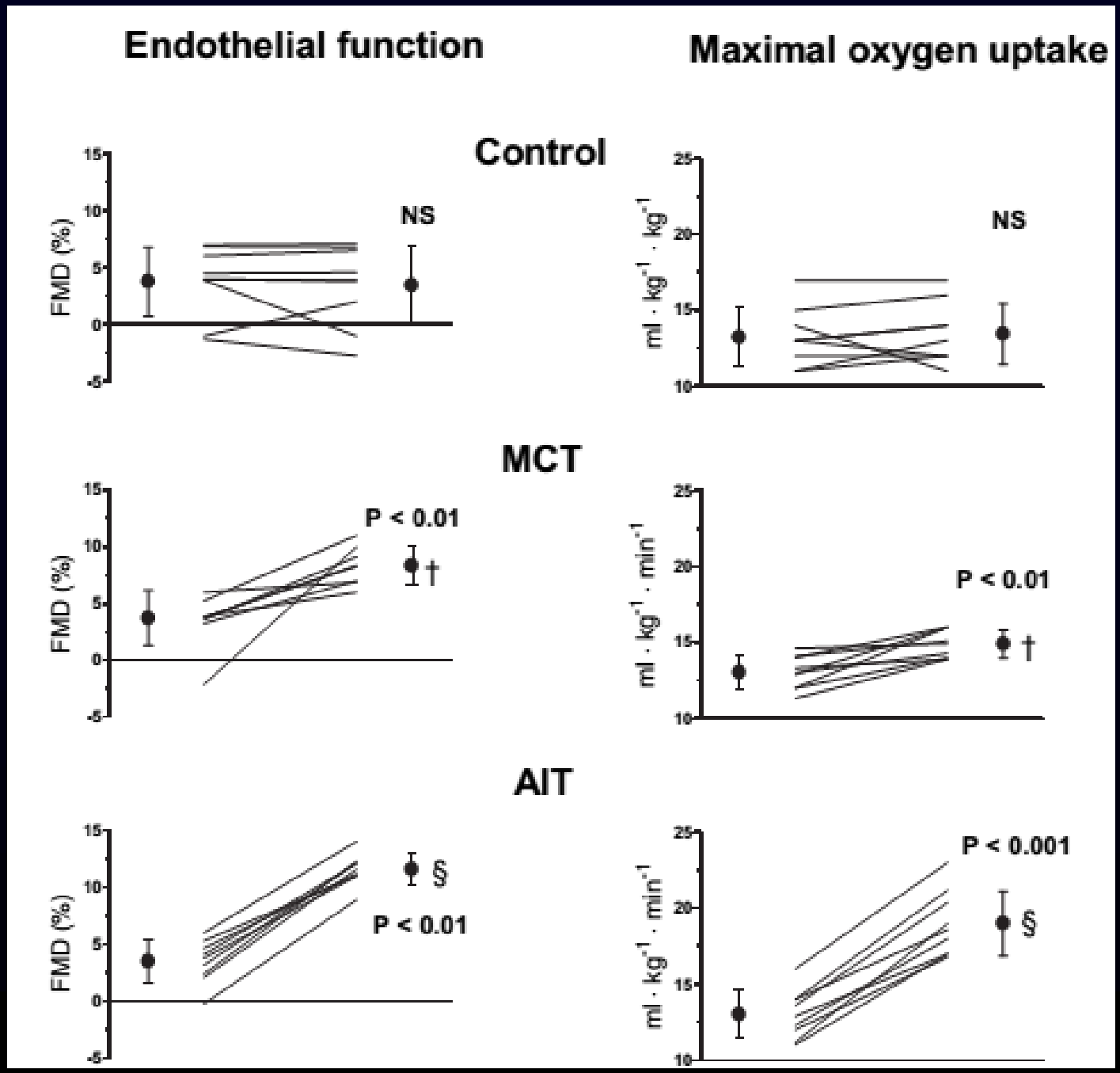
- Duração do treino de 3 semanas

Intervalado

- Aquecimento: 10 minutos (50 a 60% vo2 pico)
- 4 min (90 a 95% do vo2 pico)
- 3 min recuperação (50 a 70% vo2 pico)

Contínuo

- 70 a 75% do vo2 pico.
- Tempo total: 47 minutos


Endothelial function
Maximal oxygen uptake
Control
FMD (%)
NS
ml · kg-1 · kg-1
NS
MCT
FMD (%)
P < 0.01
†
ml · kg-1 · min-1
P < 0.01
†
AIT
FMD (%)
§
P < 0.01
ml · kg-1 · min-1
P < 0.001
§

TREINAMENTO FÍSICO NA INSUFICIENCIA CARDÍACA

TABLE 3. LV Volumes and Resting Hemodynamics

	Control		MCT		AIT	
	Baseline	Follow-Up	Baseline	Follow-Up	Baseline	Follow-Up
LVDD, mm	67.2±8.1	67.8±12.5	69.1±8.6	68.2±6.5	66.7±6.8	59.0±6.8*†
LVSD, mm	56.2±9.2	56.7±13.7	56.6±8.8	53.9±7.4	53.9±6.7	46.1±8.2*†
LVEDV, mL	250.5±64.4	242.1±62.3	245.5±53.1	230.3±41.0	248.1±79.6	202.9±72.0*†
LVESV, mL	187.8±53.0	186.6±58.6	172.9±48.7	160.6±34.3	177.4±72.1	133.9±57.8*†
HR at rest, bpm	60±11	59±11	55±10	54±12	65±14	61±13
SV, mL	53.4±15.3	55.0±13.7	63.5±12.7	63.1±15.7	57.1±14.3	67.0±19.9*
CO, L/min	3.1±0.6	3.2±0.5	3.5±0.9	3.4±1.1	3.5±0.5	3.9±0.6*
EF, %	26.2±8.0	26.6±9.7	32.8±4.8	33.5±5.7	28.0±7.3	38.0±9.8*†

Data are mean±SD. LVDD indicates LV diastolic diameter; LVSD, LV systolic diameter; LVEDV, LV end-diastolic volume; LVESV, LV end-systolic diameter; HR, heart rate; SV, stroke volume; CO, cardiac output; and EF, ejection fraction.

*Different from baseline, $P<0.01$; †different from controls and moderately trained, $P<0.02$.

EFEITOS CRÔNICOS DO TREINAMENTO DE FORÇA NA INSUFICIÊNCIA CARDÍACA

Combined aerobic and resistance exercise training improves functional capacity and strength in CHF

Maiorana, A. et al., J Appl Physiol 88: 1565–1570, 2000

- Randomizados em grupo combinado e controle
- Capacidade funcional, força, antropometria e composição corporal
- 8 semanas de treinamento
- 3 x na semana
- 1 hora

Combined aerobic and resistance exercise training improves functional capacity and strength in CHF

Maiorana, A. et al., J Appl Physiol 88: 1565–1570, 2000

GRUPO COMBINADO (circuito)

- **Combinação de aeróbio (bicicleta e caminhada) com força.**
- **7 exercícios de força alternados com 8 aeróbios**
- **Força 15 rep (15 seg de intervalo) finalizava com 5 min de aeróbio**
- **Força com 55% da CVM (4 semanas) para 65% da CVM**
- **Aeróbio com 70% da FC pico (6 semanas) para 85% FC pico**

Combined aerobic and resistance exercise training improves functional capacity and strength in CHF

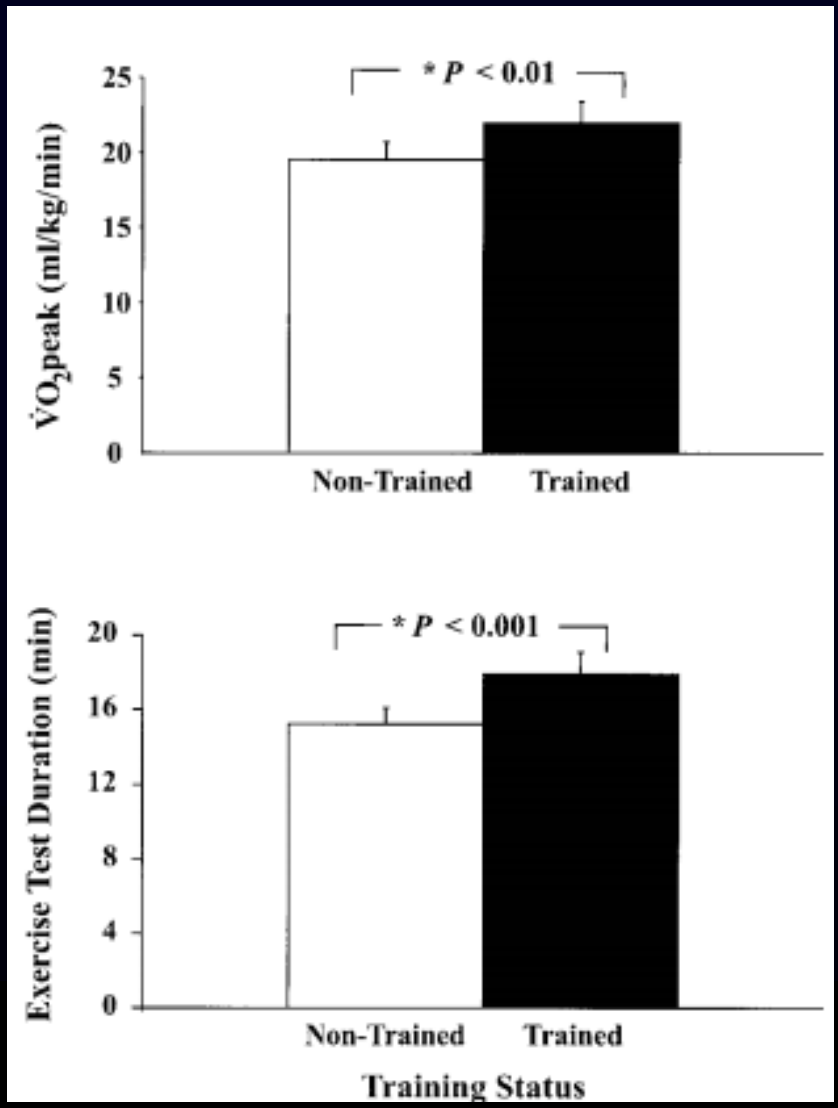
Maiorana, A. et al., J Appl Physiol 88: 1565–1570, 2000

Table 2. *Anthropometric characteristics following trained and untrained periods*

	Untrained	Trained
Body weight, kg	87.3 ± 3.4	86.6 ± 3.2
BMI	28.7 ± 1.0	28.5 ± 0.9
Hip-to-waist ratio	1.04 ± 0.02	1.05 ± 0.02
Sum of 8 skinfolds, mm	138.8 ± 10.0	132.9 ± 8.1
Sum of 5 segment girths, mm	325.6 ± 6.8	322.3 ± 6.3
Muscle strength		
Sum of 7 maximal contractions, kg	392 ± 26	462 ± 22*

Combined aerobic and resistance exercise training improves functional capacity and strength in CHF

Maiorana, A. et al., J Appl Physiol 88: 1565–1570, 2000



Combined aerobic and resistance exercise training improves functional capacity and strength in CHF

Maiorana, A. et al., J Appl Physiol 88: 1565–1570, 2000

- Treinamento combinado (circuito) aumentou a força, tempo de teste e aumentou o consumo de oxigênio pico

Is Strength Training the More Efficient Training Modality in Chronic Heart Failure?

Feiereisen, P. et al. Med. Sci. Sports Exerc.39:1910–1917, 2007

Pacientes com IC (II e III da NYHA FE < 35%)

- Randomizados

- Aeróbio, força, combinado. (Grupo controle)

- 40 sessões com frequência de 3 x na semana

- Função cardíaca, capacidade funcional, força, qualidade de vida

Is Strength Training the More Efficient Training Modality in Chronic Heart Failure?

Feiereisen, P. et al. Med. Sci. Sports Exerc.39:1910–1917, 2007

Para todos os grupos cada sessão era constituída:

- Duração de 45 min

- 5 min de aquecimento (30% do VO_2 pico)

- 40 min parte principal

Is Strength Training the More Efficient Training Modality in Chronic Heart Failure?

Feiereisen, P. et al. Med. Sci. Sports Exerc.39:1910–1917, 2007

Exercício aeróbio

- Após o aquecimento
- 20 min bike(FC no 65% do VO_2 pico) Após 10 S (75%)
- 20 min de esteira (inclinação e velocidade)
- Ajustes eram realizados para FC

Is Strength Training the More Efficient Training Modality in Chronic Heart Failure?

Feiereisen, P. et al. Med. Sci. Sports Exerc.39:1910–1917, 2007

Exercício de força

- Após o aquecimento

- 10 exercícios para membros superiores e inferiores

- 4 séries de 10 rep (3 seg concêntrica 3 seg excêntrica
- (2 min intervalo) - 40 min

- 60% de 1 RM (20 sessões) 70% de 1 RM

Is Strength Training the More Efficient Training Modality in Chronic Heart Failure?

Feiereisen, P. et al. Med. Sci. Sports Exerc.39:1910–1917, 2007

Exercício combinado

- Após o aquecimento

- 20 min bike(FC no 65% do VO2 pico) Após 10 S (75%)

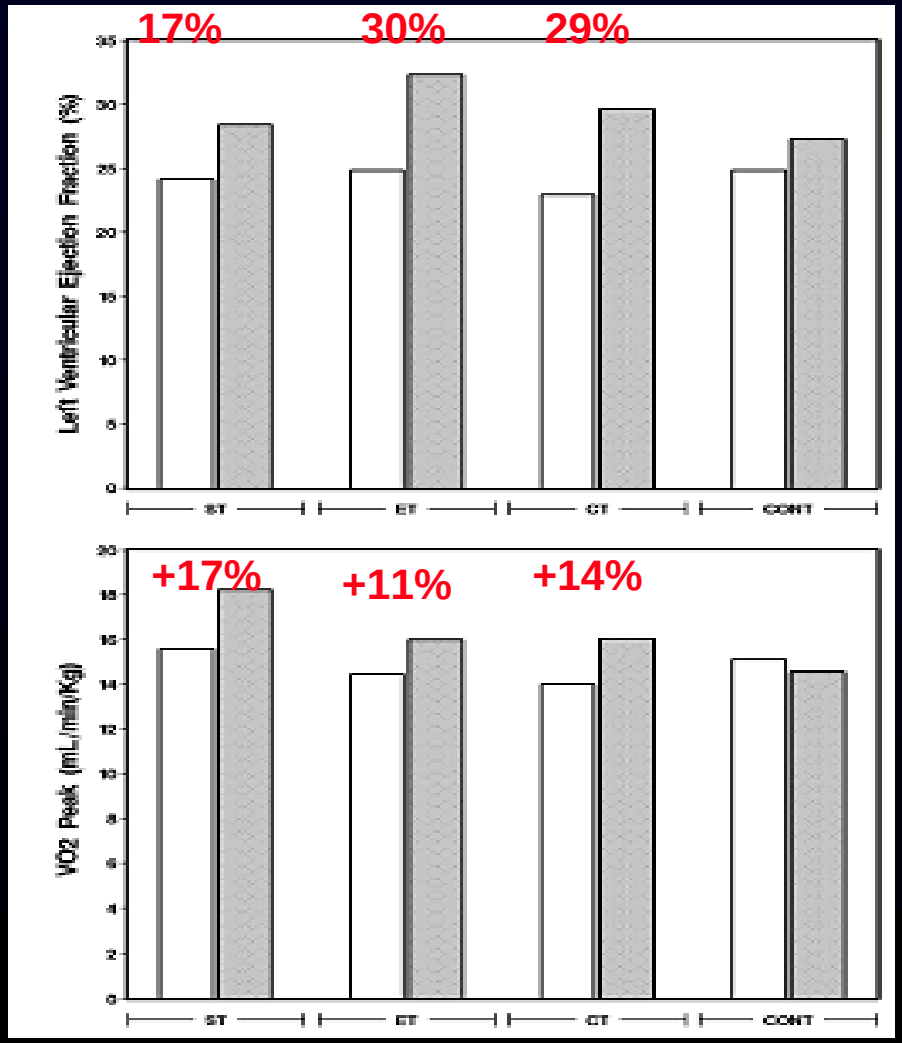
- 5 exercícios para membros superiores e inferiores
(pull down, reverse butterfly, rowing, knee extension, knee flexion)

- 60% de 1 RM (20 sessões) 70% de 1 RM

- 20 minutos de força e 20 minutos de aeróbio

Is Strength Training the More Efficient Training Modality in Chronic Heart Failure?

Feiereisen, P. et al. Med. Sci. Sports Exerc.39:1910–1917, 2007



Is Strength Training the More Efficient Training Modality in Chronic Heart Failure?

Feiereisen, P. et al. Med. Sci. Sports Exerc.39:1910–1917, 2007

- 3 modalidades foram idênticas na melhora da:

- Capacidade funcional

- Função cardíaca

- Função dos músculos periféricos

Randomized trial of progressive resistance training to counteract the myopathy of chronic heart failure

Pu, CT, et al. J Appl Physiol 90: 2341–2350, 2001

- Mulheres com IC (65 anos ou mais)

- Classe funcional I a III do NYHA

- Treinamento de força e placebo

- Capacidade funcional, função muscular, função do coração, força muscular

Randomized trial of progressive resistance training to counteract the myopathy of chronic heart failure

Pu, CT, et al. J Appl Physiol 90: 2341–2350, 2001

- TREINAMENTO DE FORÇA (60 minutos)

- 3 X na semana (10 semanas)

-Exercício para membros superiores e inferiores (seated leg press, chest press, knee extension, triceps and knee flexion)

- 3 séries de 8 repetições (80% 1 RM) com 60 a 90 seg de -intervalo

- 1 a 3 minutos entre os exercícios

Randomized trial of progressive resistance training to counteract the myopathy of chronic heart failure

Pu, CT, et al. J Appl Physiol 90: 2341–2350, 2001

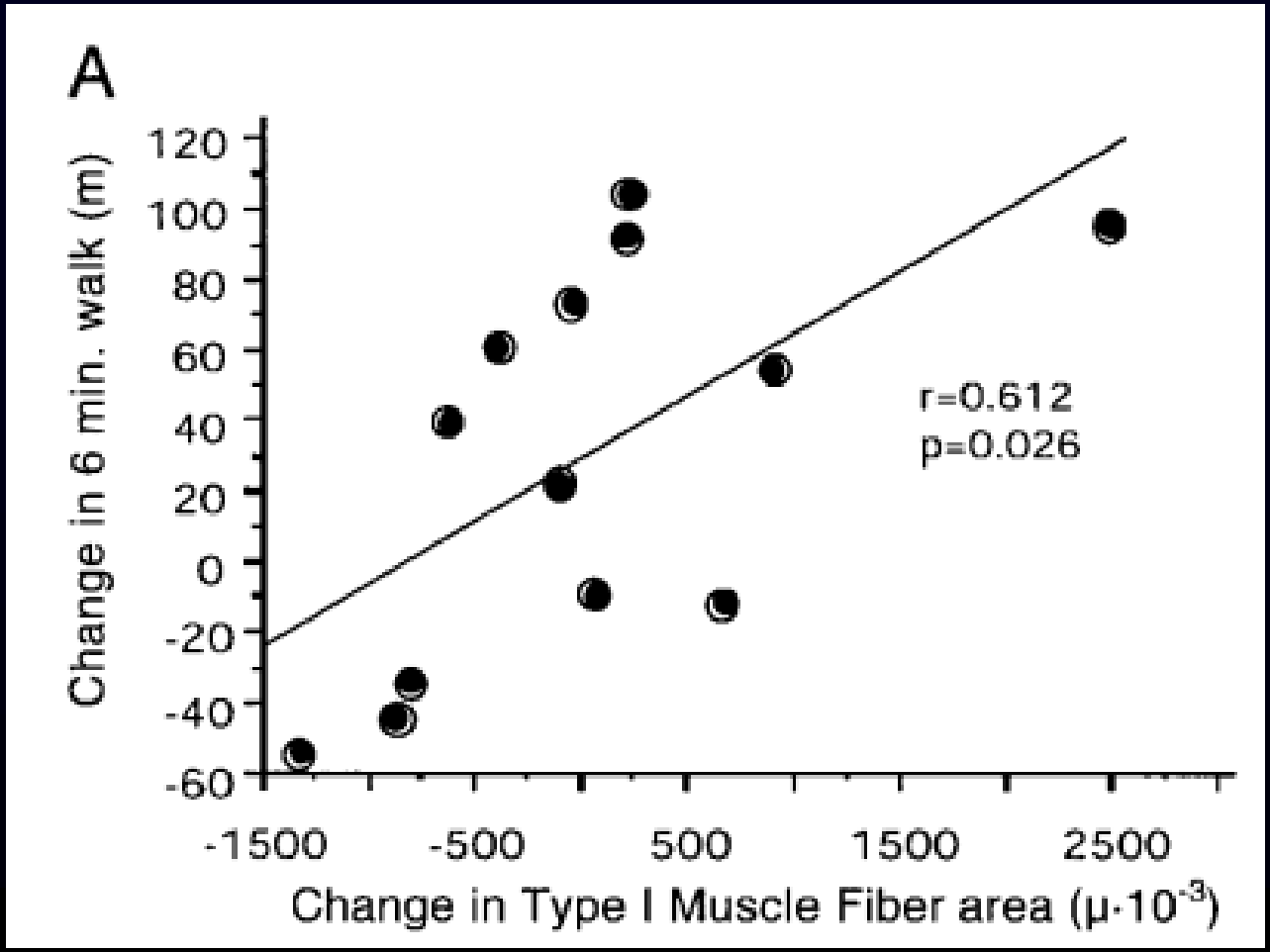
Table 5. *Effect of intervention on overall exercise tolerance*

Overall Exercise Tolerance Measure	Resistance Training Group (n = 9)		Placebo Control Group (n = 7)		P Value	
	Pre	Post	Pre	Post	Time	Group × time
Aerobic exercise capacity						
Peak $\dot{V}O_2$, ml·kg^{-1}·min^{-1}	15.46 ± 1.04	15.08 ± 1.62	14.40 ± 1.13	14.75 ± 0.94	0.88	0.41
Peak $\dot{V}E$	28.9 ± 2.4	28.2 ± 2.9	32.1 ± 2.9	29.7 ± 2.4	0.38	0.64
Peak RER	0.99 ± 0.04	0.92 ± 0.04	0.91 ± 0.03	0.89 ± 0.03	0.07	0.44
Peak HR, beats/min	120 ± 7	111 ± 9	128 ± 12	128 ± 12	0.17	0.24
Treadmill time to exhaustion, s	438 ± 68	485 ± 57	423 ± 36	382 ± 26	0.69	0.06
Functional performance						
6-min walk, m	372 ± 42	421 ± 50	365 ± 42	362 ± 31	0.91	0.036

Values are means ± SE. $\dot{V}O_2$, aerobic capacity; $\dot{V}E$, exhalation flow rate; RER, respiratory exchange ratio; HR, heart rate.

Randomized trial of progressive resistance training to counteract the myopathy of chronic heart failure

Pu, CT, et al. J Appl Physiol 90: 2341–2350, 2001



Randomized trial of progressive resistance training to counteract the myopathy of chronic heart failure

Pu, CT, et al. J Appl Physiol 90: 2341–2350, 2001

- **Treinamento de força em mulheres com IC:**

- **Melhorou a capacidade funcional**

- **Força muscular**

- **Diferenciação das fibras musculares**

- **Sem mudanças estruturais cardíacas**

TREINAMENTO DE FORÇA EM PACIENTES COM IC

- Parece ser seguro

- Melhora o tempo de teste

- Melhora o VO_2 pico

- Melhora a força e resistência muscular

- Melhora do perfil das fibras musculares

- A maioria dos estudos foi em pacientes no estágio II a III NYHA

- Apesar das evidências, complemento do aeróbio

REVIEW ARTICLE

Sports Med 2005; 35 (12): 1085-1103
0112-1642/05/0012-1085/$34.95/0

Resistance Exercise Training in Patients with Heart Failure

Konstantinos A. Volaklis and *Savvas P. Tokmakidis*

Department of Physical Education and Sport Science, Democritus University of Thrace, Komotini, Greece

Contents

TREINAMENTO FÍSICO NA INSUFICIENCIA CARDÍACA

- **Tipo**
  - Principalmente aeróbicos
  - Treinamento de força com cargas baixas
- **Intensidade**
  - Abaixo do PCR
  - 60-80% da FC reserva (12-14 borg)
- **Duração**
  - 10-20 min (iniciantes)
  - 20-40 min
- **Frequencia**
  - 3-5 x sem

Myers (2008)

RGV, 65 masculino, casado, aposentado, natural de Olinda

Procurou professor de educação física para reabilitação cardíaca.

Aos 36 anos fez uma cirurgia cardíaca e colocou três pontes. Quinze anos depois colocou dois stents. Está bem desde então. Nega dor precordial. Tem diabetes há 17 anos.

- **Ecocardiograma: FE = 0.52 (> 0.70), DVED – 58 mm, DVES – 49 mm, Septo 9 mm, EP 9 mm**

- **Glicemia de jejum = 105 mg/dl (70 – 110 mg/dl; DM ≥ 126 mg/dl)**
- **Hemoglobina glicada = 6,5 % (< 7 %)**
- **Colesterol total = 230 mg/dl (< 200 mg/dl)**
- **HDL = 40 mg/dl (> 35 mg/dl)**
- **LDL = 190 mg/dl (< 130 mg/dl)**
- **Triglicérides = 157 mg/dl (<150 mg/dl)**
- **ITB: 0,97 (membro direito), 1,15 (membro esquerdo (>0,90)**

- **Medicamentos em uso: Balcor ® (diltiazen) 30 mg três vezes/dia, Moduretic (hidroclorotiazida e amilorida) 50 mg 1x/dia, Zocor ® (sinvastatina) 10 mg/dia, Somalgin Cardio ® (aspirina) 325 mg/dia, Prandin ® (repaglinida) uma mg às refeições e Ticlid (ticlopidinal) 200 mg 3x/dia**