Cardiorespiratory Fitness, Cardiovascular Disease Risk Factors and Subclinical Atherosclerosis in Male Adolescents

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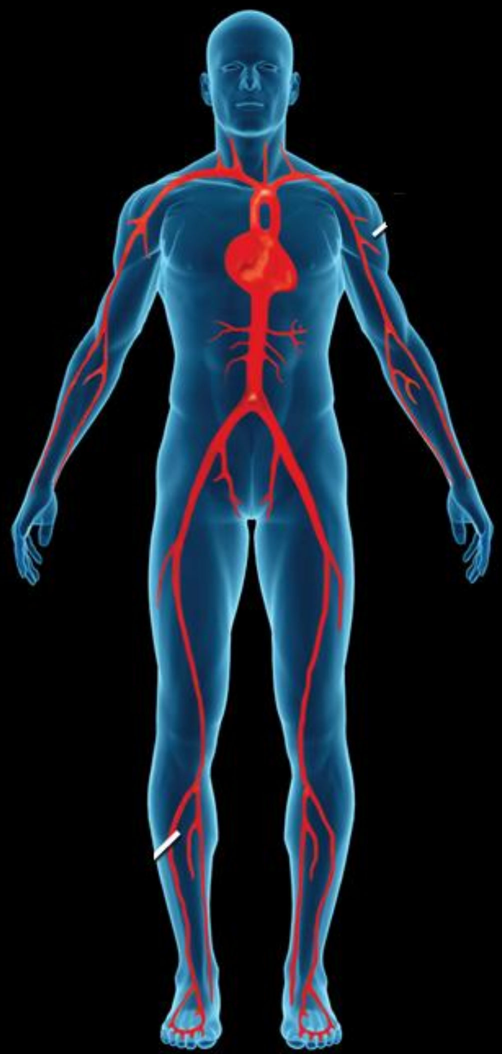
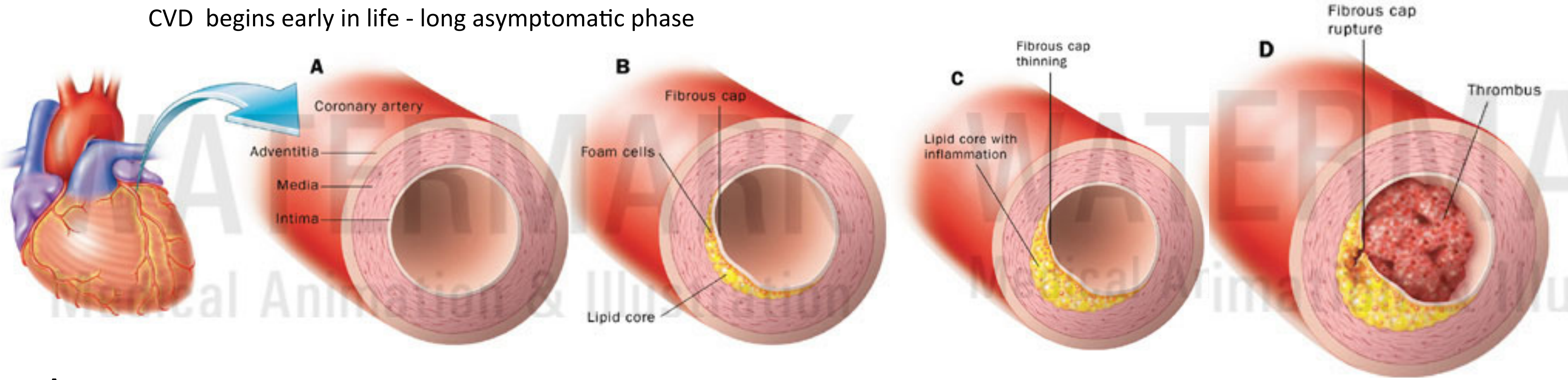
Coronary Artery Disease



- Begins early in life due to exposure to risk factors
- Lag time between onset of CAD in childhood and clinical manifestation in middle and late adulthood

Atherosclerotic Progression
Review

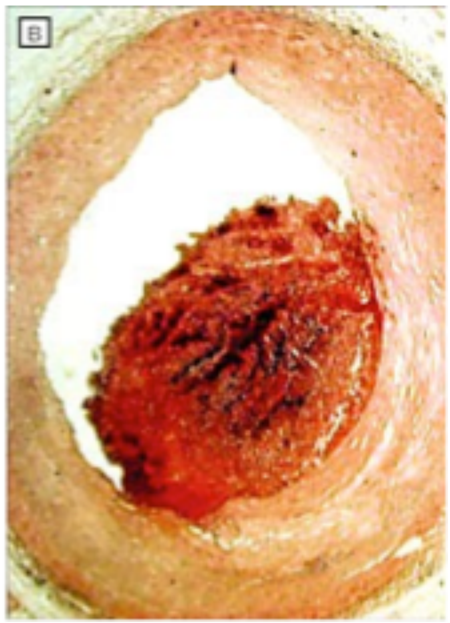
CVD begins early in life - long asymptomatic phase

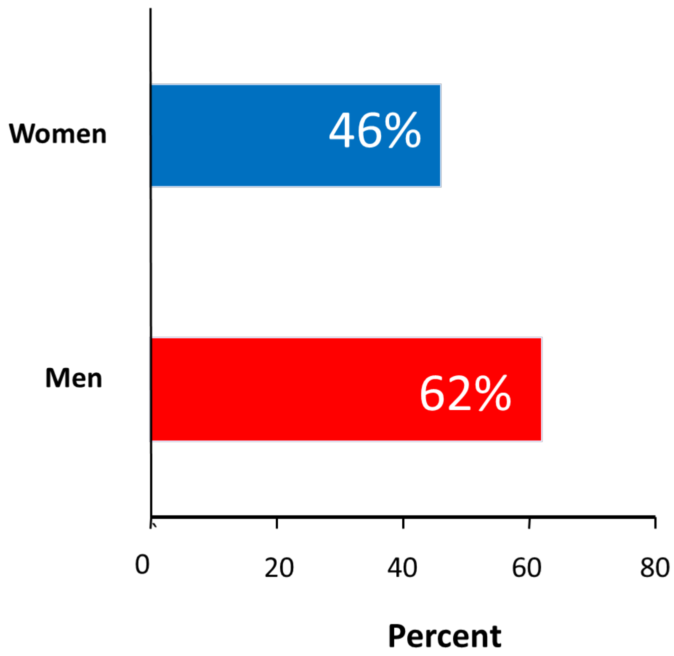


Age
Gender
Family Hx
Race

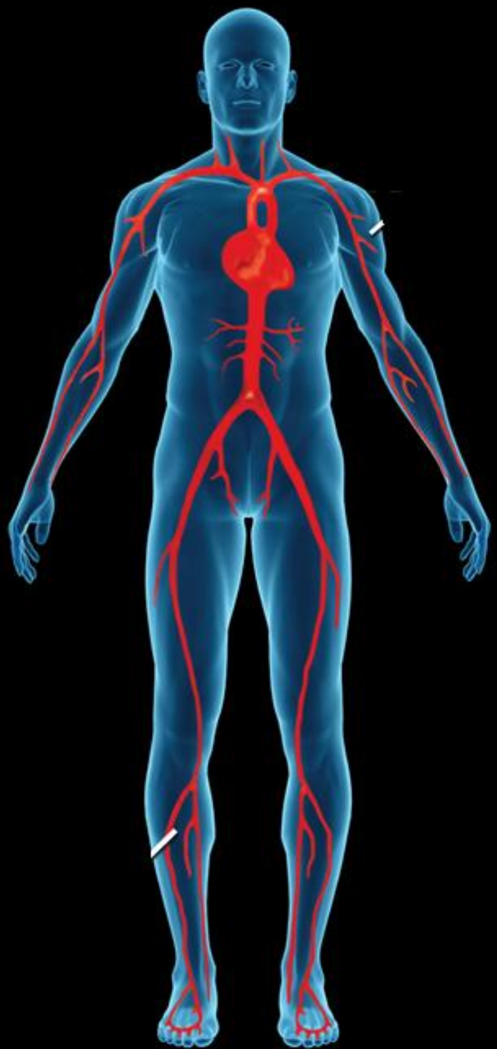
Modifiable

- Cigarette smoking
- High blood pressure
- High LDL (bad) cholesterol
- Impaired fasting glucose
- Obesity
- Low Cardiorespiratory Fitness

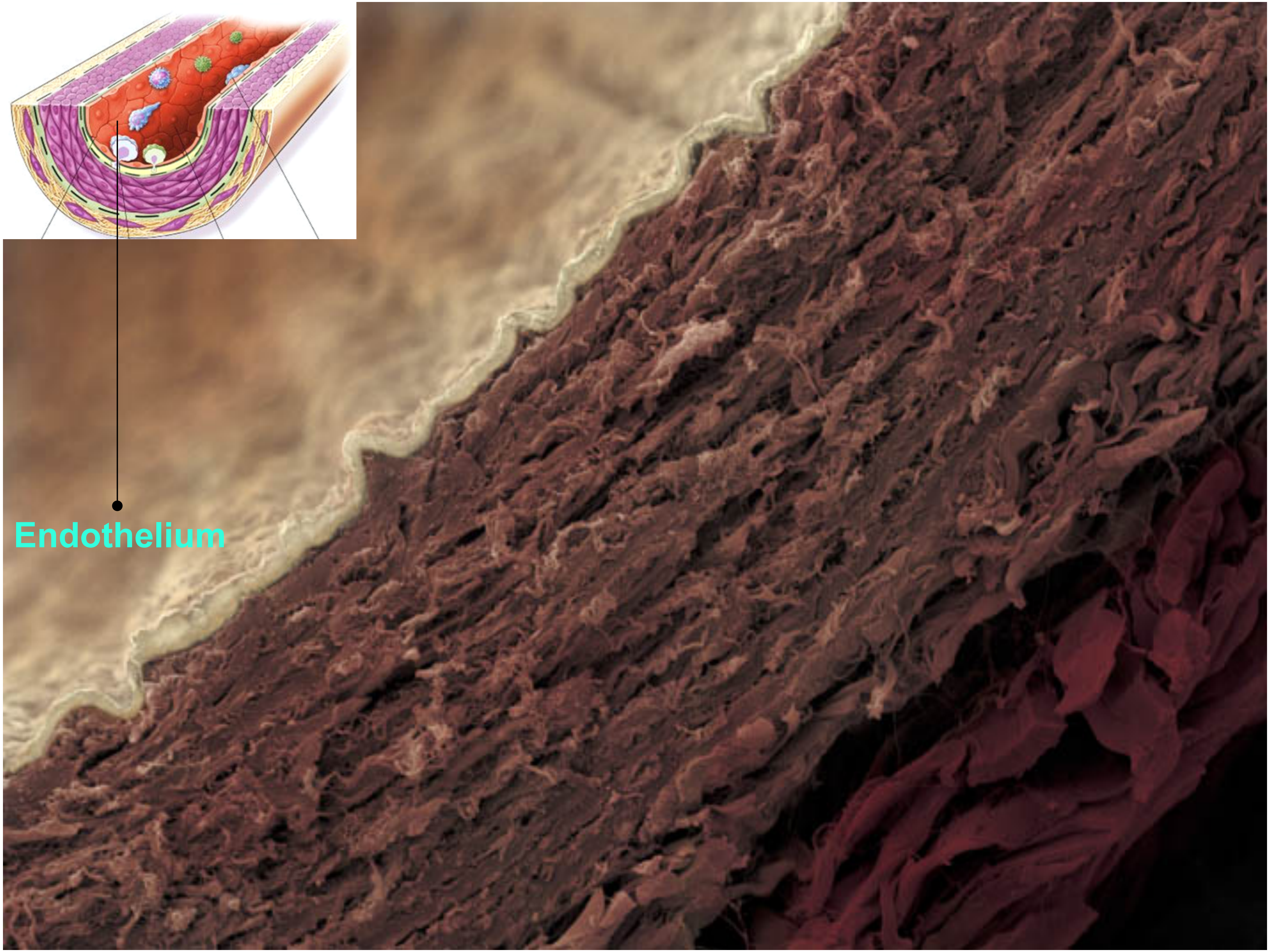




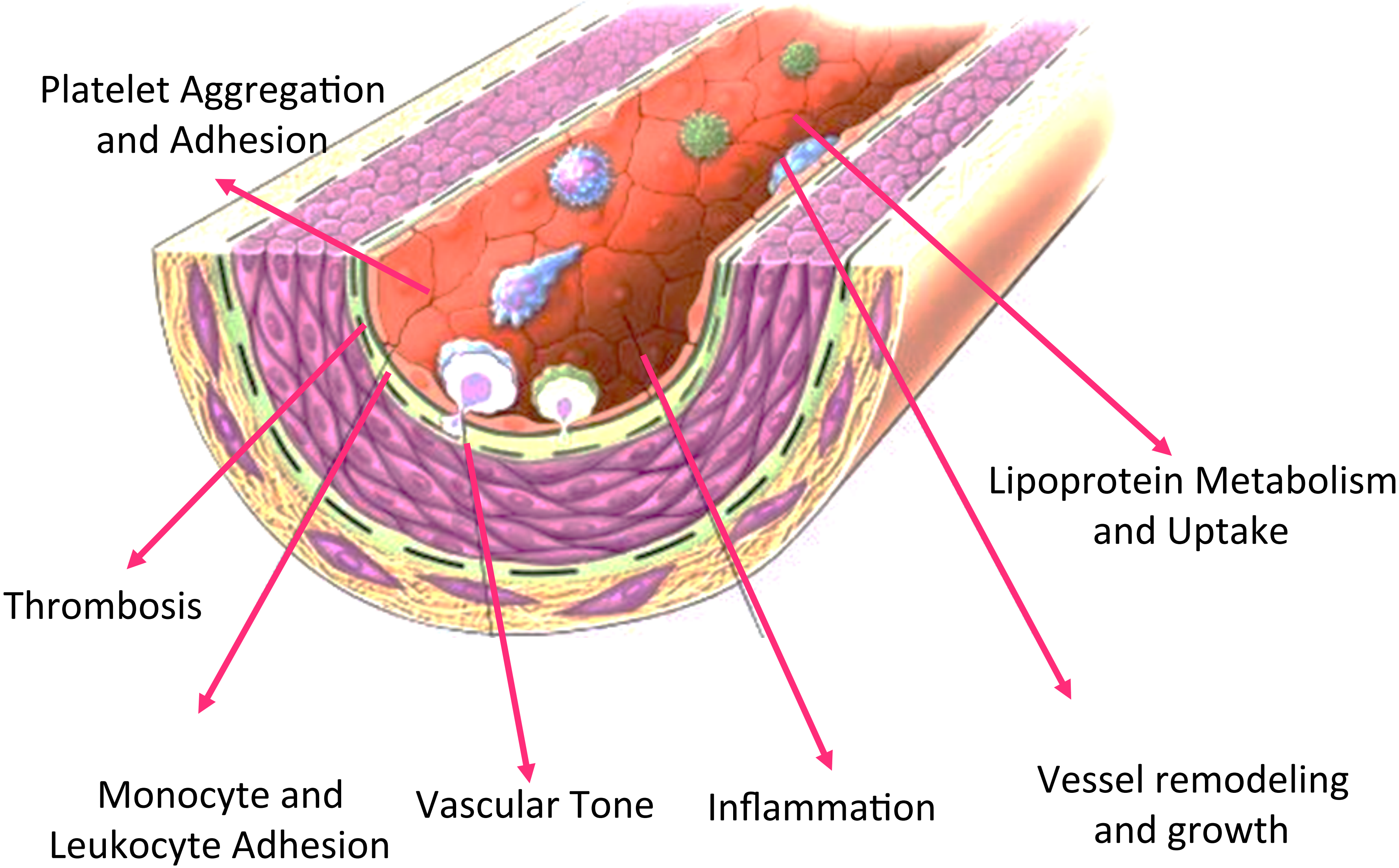
Coronary Artery Disease

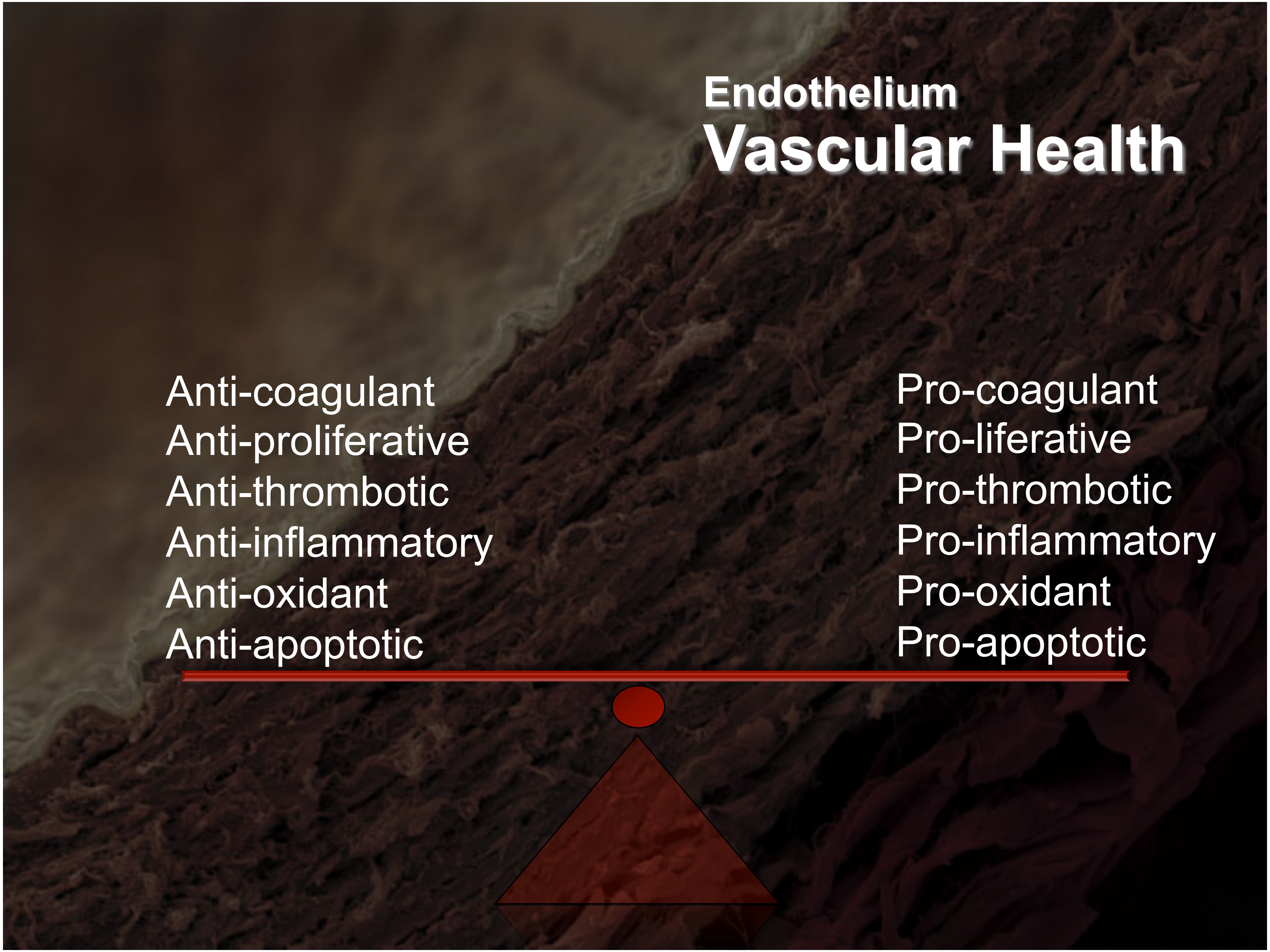


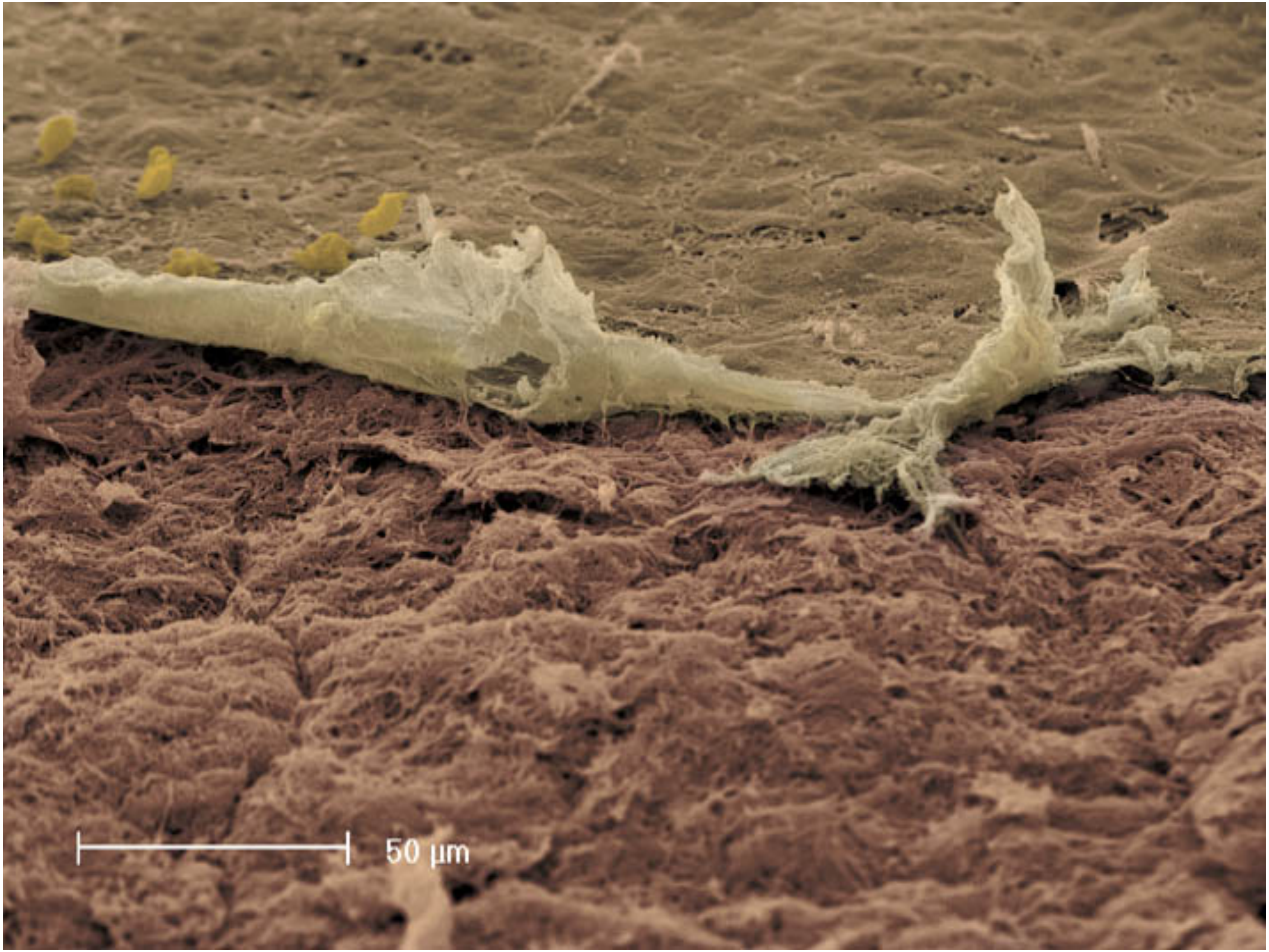
- Begins early in life due to exposure to risk factors
- Lag time between onset of CAD in childhood and clinical manifestation in middle and late adulthood
- Duration of risk factor burden is a major factor governing the development of CVD
- CVD risk factor levels and health behaviours for an individual tend to persist or track over time

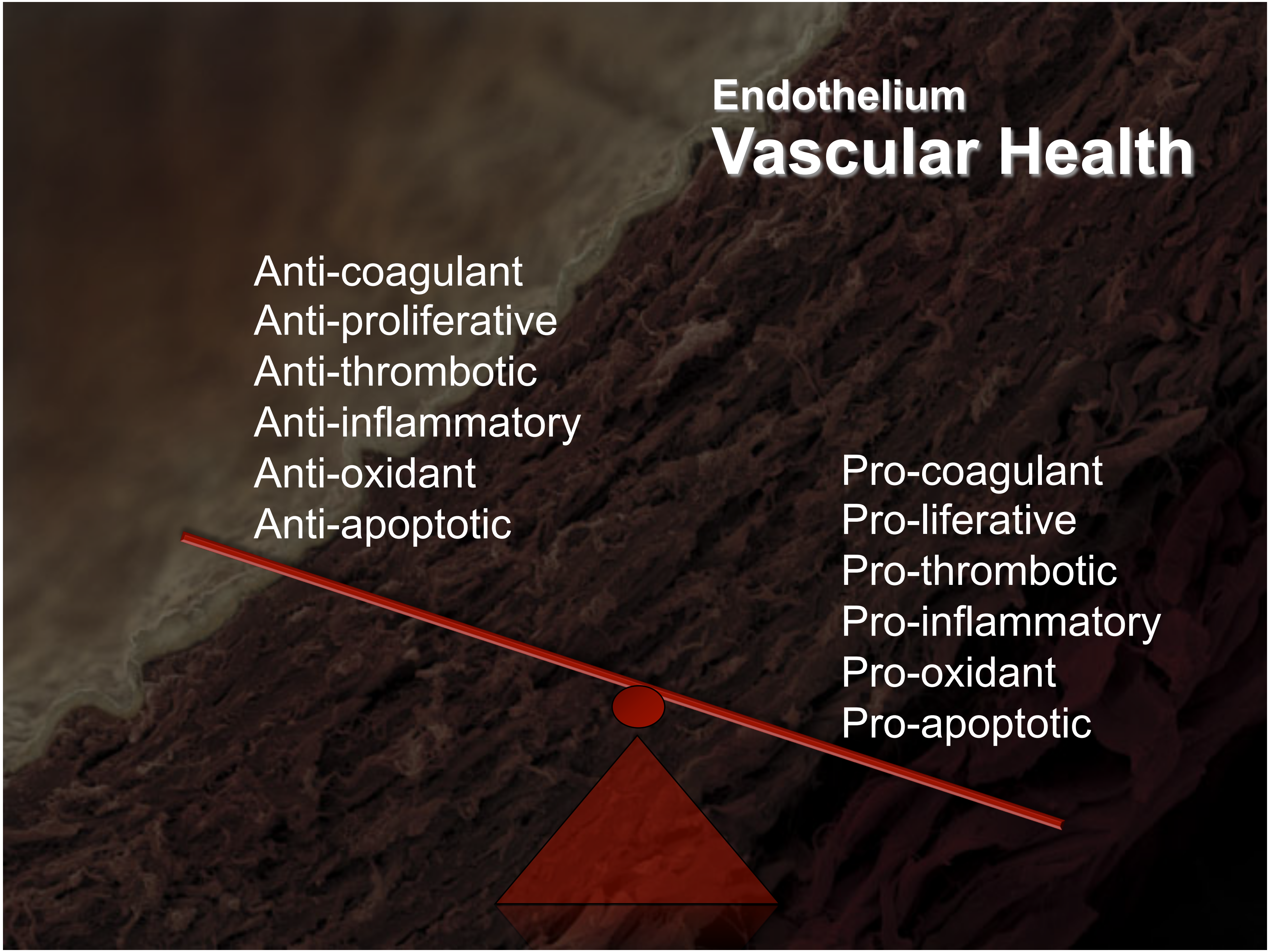

Endothelium

Vascular Endothelium
Functions

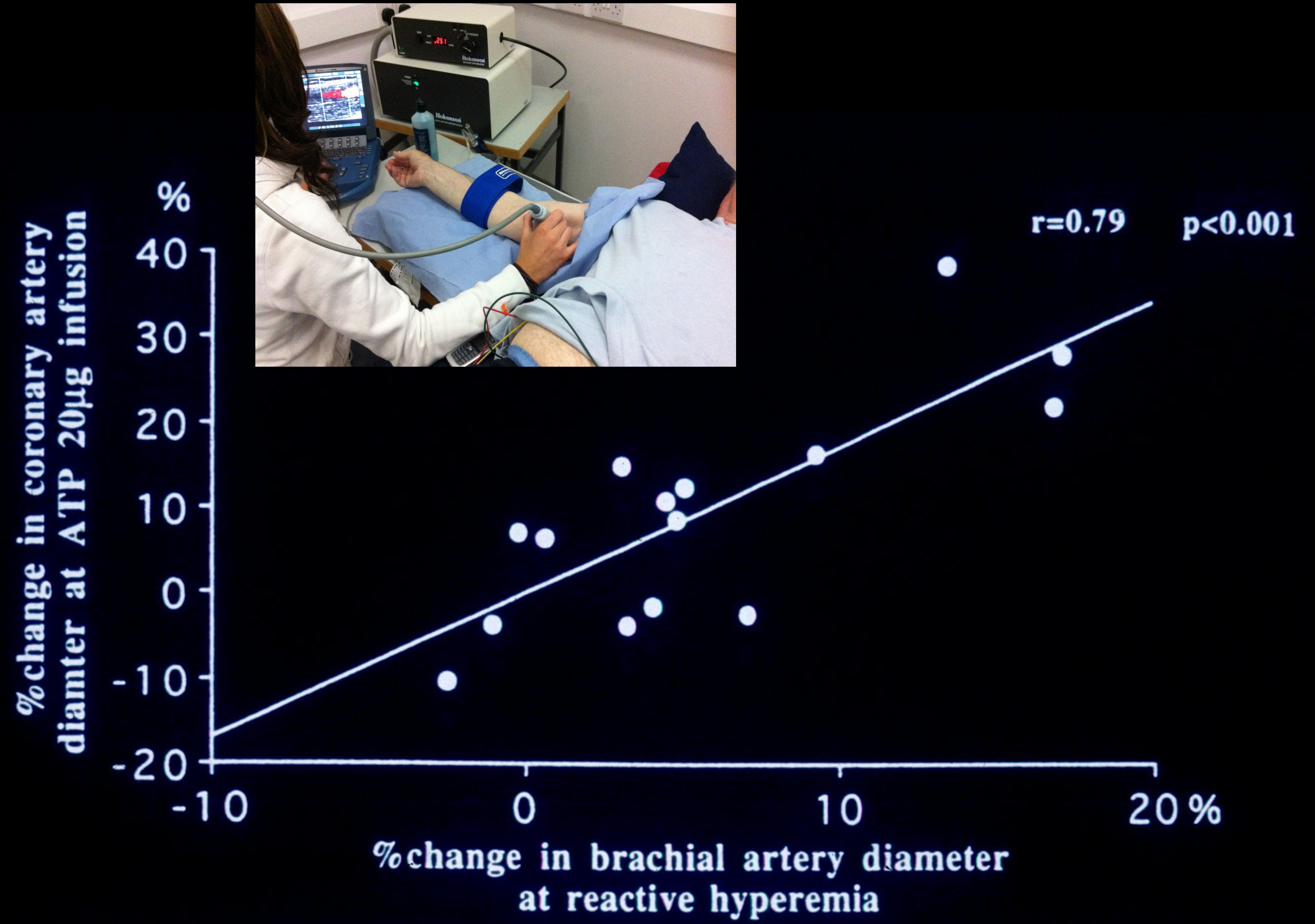



Endothelium
Vascular Health
Anti-coagulant
Anti-proliferative
Anti-thrombotic
Anti-inflammatory
Anti-oxidant
Anti-apoptotic
Pro-coagulant
Pro-liferative
Pro-thrombotic
Pro-inflammatory
Pro-oxidant
Pro-apoptotic

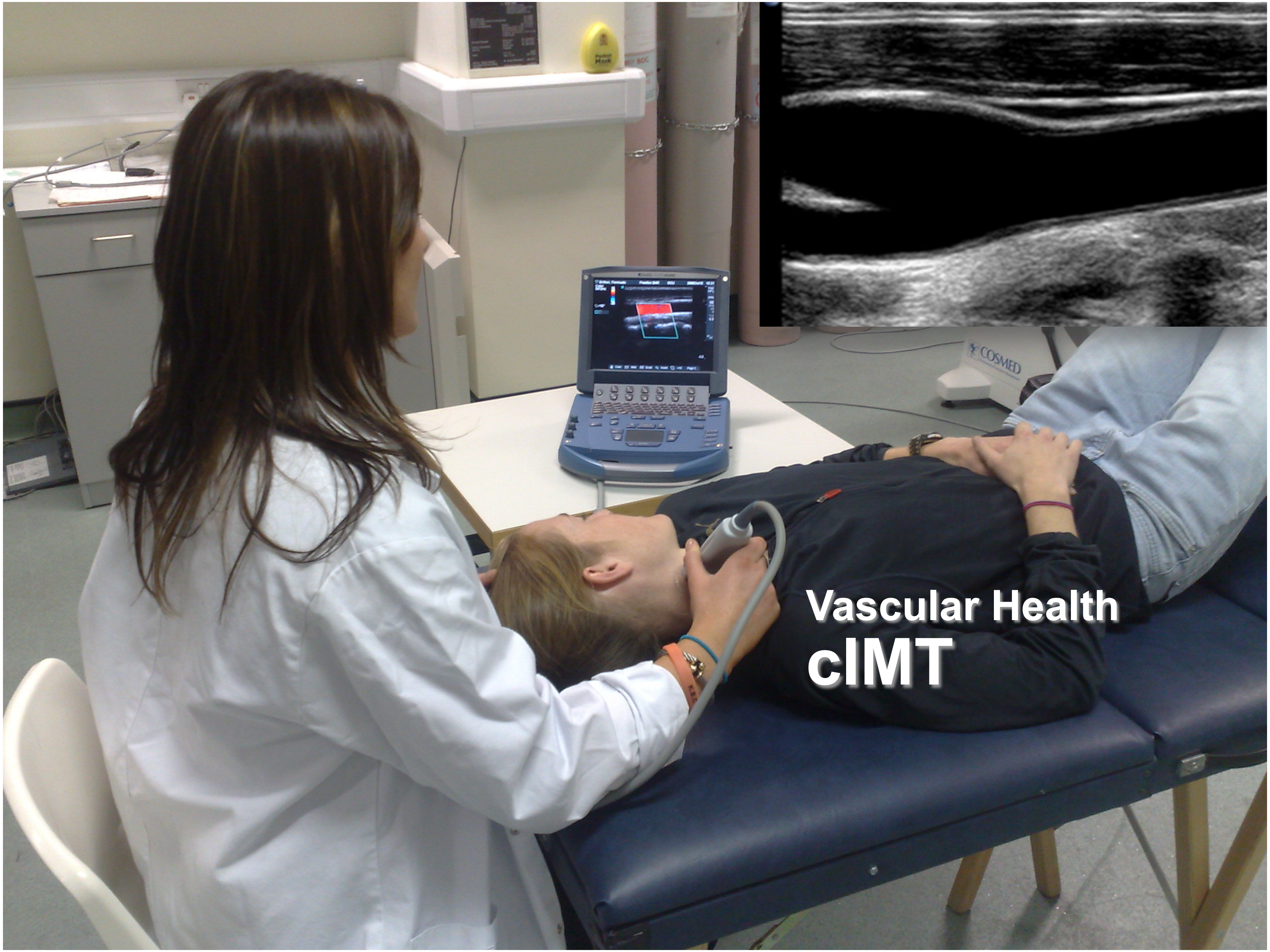

50 µm


Endothelium
Vascular Health
Anti-coagulant
Anti-proliferative
Anti-thrombotic
Anti-inflammatory
Anti-oxidant
Anti-apoptotic
Pro-coagulant
Pro-liferative
Pro-thrombotic
Pro-inflammatory
Pro-oxidant
Pro-apoptotic


Assessment of
Endothelial Function
Hokanson
Hokanson

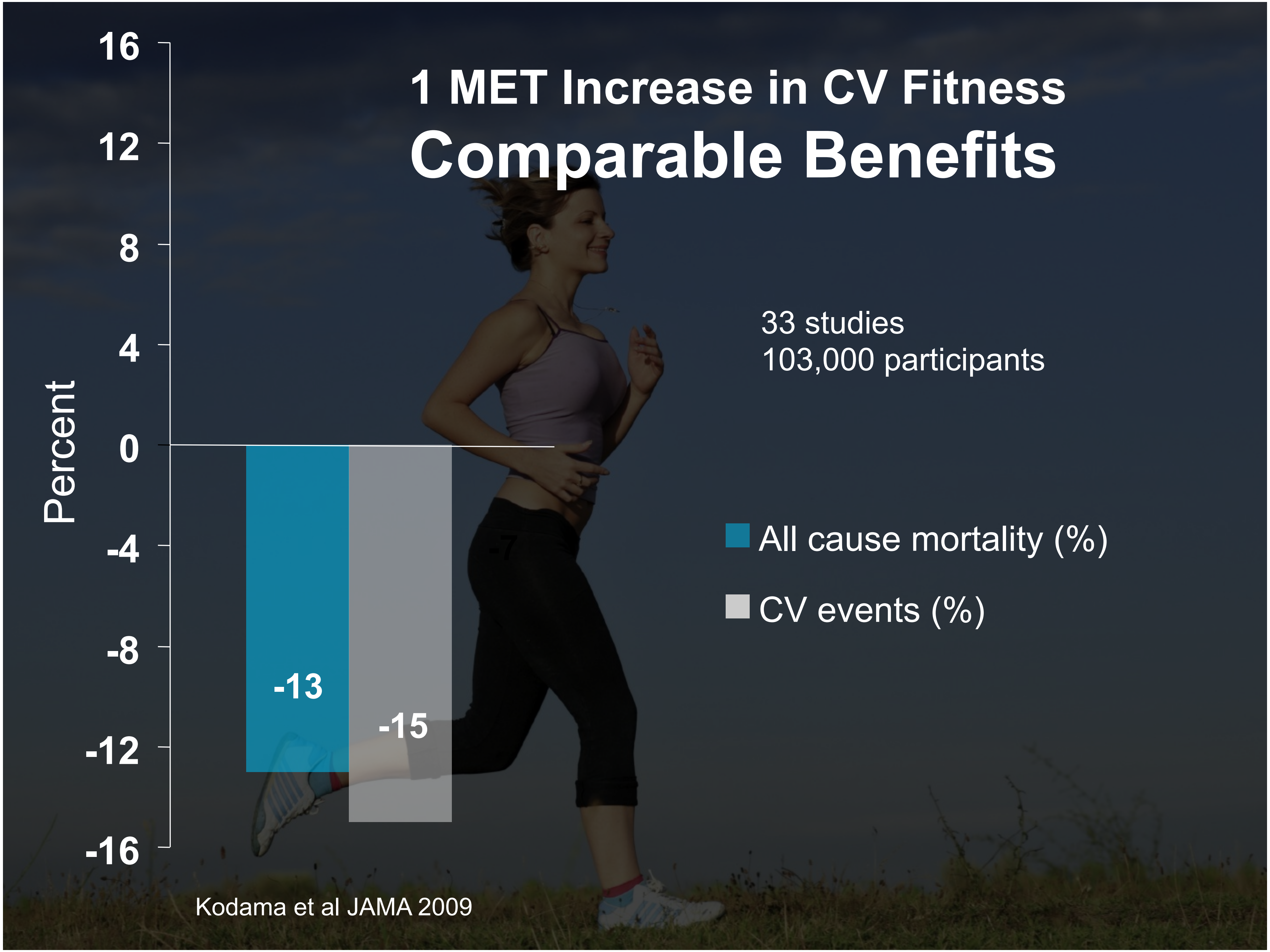


Takase B, Am J Cardiol 1998:82:1535; Comparison of Brachial and Coronary Flow-Mediated Vasodilation


Vascular Health
cIMT

Cardiorespiratory Fitness

Considered a stronger predictor for CVD and all-cause mortality than traditional risk factors


1 MET Increase in CV Fitness
Comparable Benefits
33 studies
103,000 participants
Percent
16
12
8
4
0
-4
-8
-12
-16
-13
-15
All cause mortality (%)
CV events (%)
Kodama et al JAMA 2009

Exercise Training Normalizes Vascular Dysfunction and Improves Central Adiposity in Obese Adolescents

Katie Watts, BSc(Hons),* Petra Beye, MD,† Aris Siafarikas, MD,† Elizabeth A. Davis, FRACP,†‡
Timothy W. Jones, FRACP,†‡ Gerard O'Driscoll, FRACP,*§ Daniel J. Green, PhD*§
Crawley, Subiaco, and Perth, Western Australia

Effects of Diet and Exercise on Obesity-Related Vascular Dysfunction in Children

Kam S. Woo, Ping Chook, Chung W. Yu, Rita Y.T. Sung, Mu Qiao, Sophie S.F. Leung,
Christopher W.K. Lam, Con Metreweli and David S. Celermajer

Circulation. 2004;109:1981-1986; originally published online April 5, 2004;
doi: 10.1161/01.CIR.0000126599.47470.BE

INFLAMMATION, INSULIN, AND ENDOTHELIAL FUNCTION IN OVERWEIGHT CHILDREN AND ADOLESCENTS: THE ROLE OF EXERCISE

Aaron S. Kelly, PhD, Rachel J. Wetzsteon, BS, Daniel R. Kaiser, PhD, Julia Steinberger, MD, MS, Alan J. Bank, MD,
and Donald R. Dengel, PhD

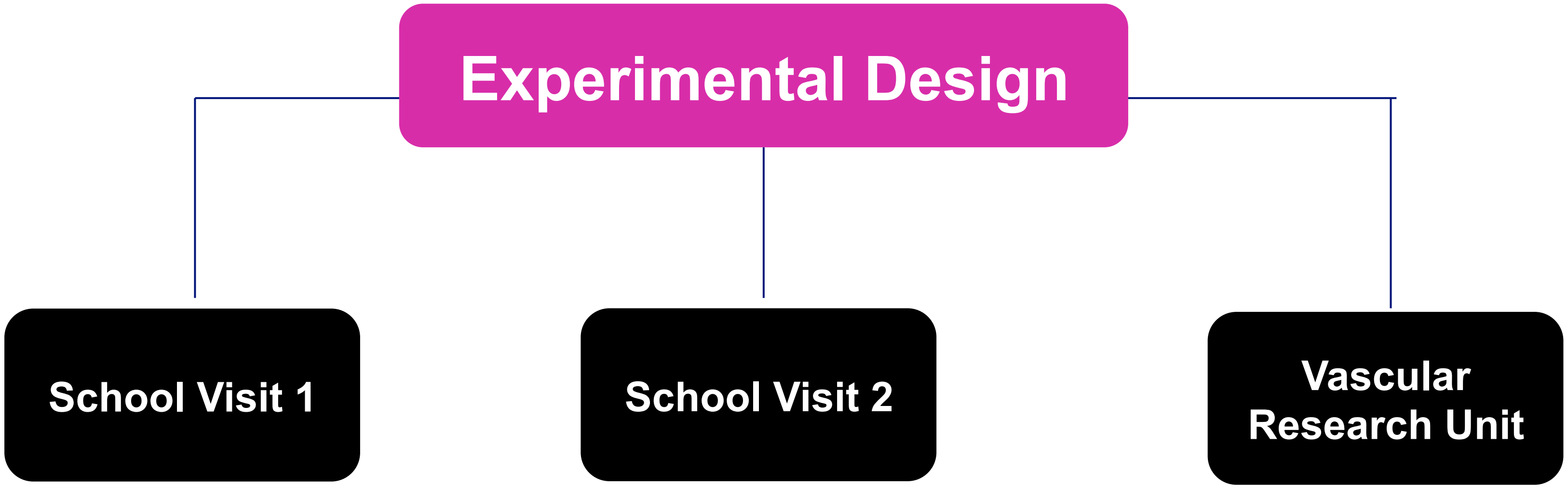
Purpose

Compare selected CVD risk factors and subclinical atherosclerosis in male adolescents with low, moderate and high cardiorespiratory fitness

- Differences in CVD risk factors, cIMT and EF
- Relation between CRF level and EF &cIMT

Study

Research Design

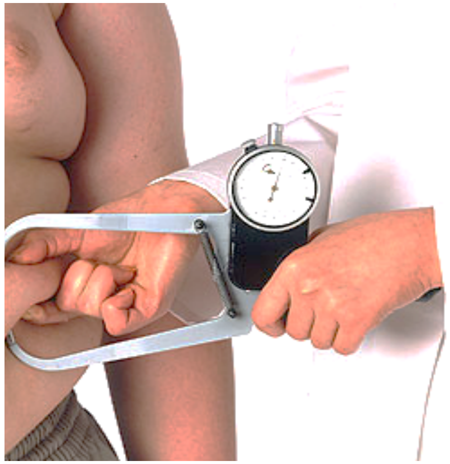


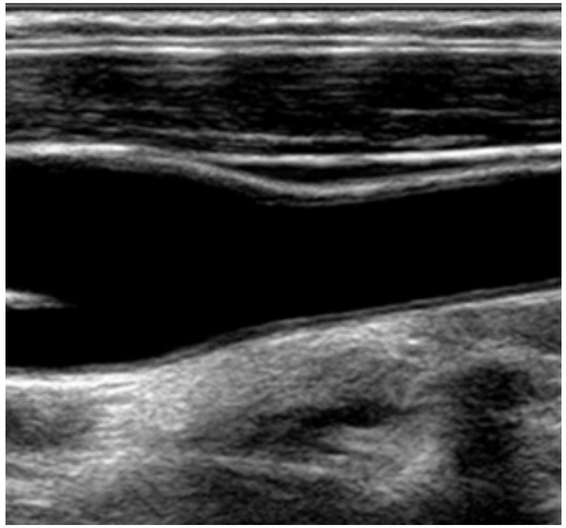

20 MST

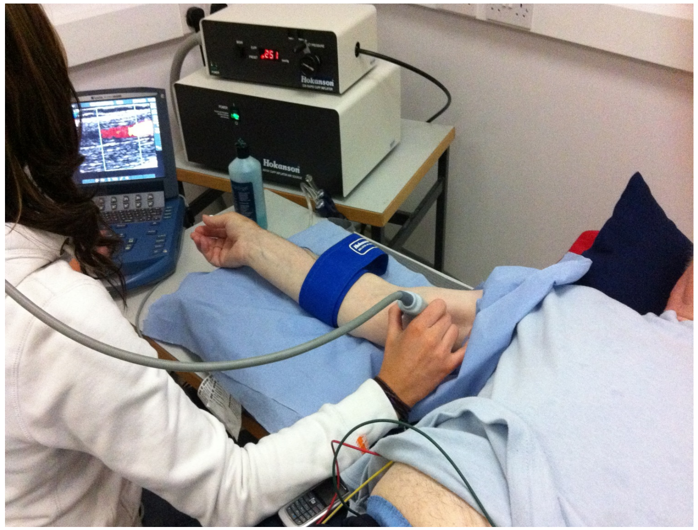
Study

Vascular Research Unit Visit

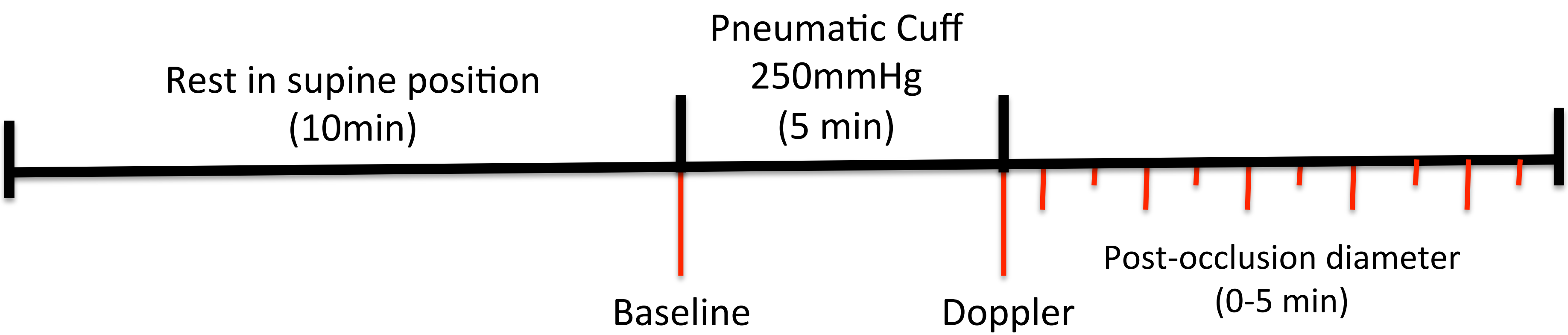
N= 66
15-17 yrs
Non Smokers

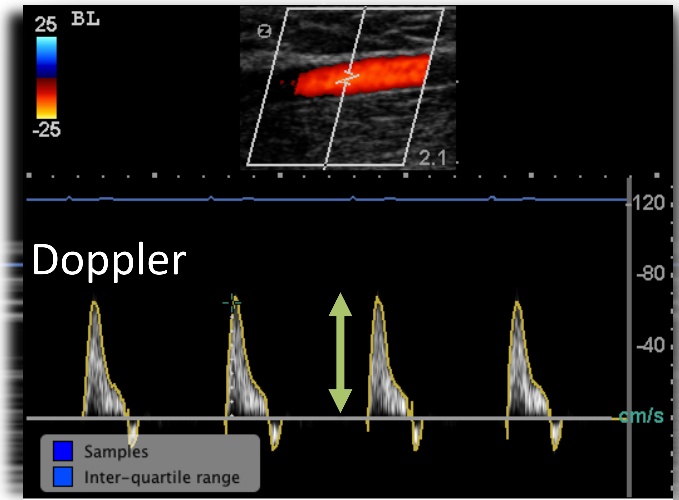


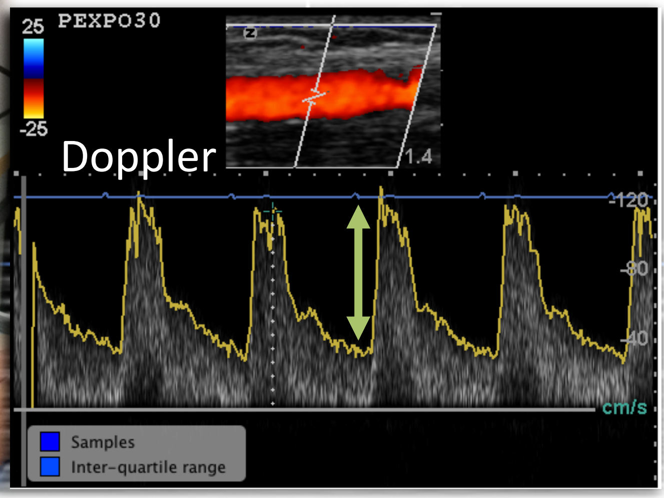




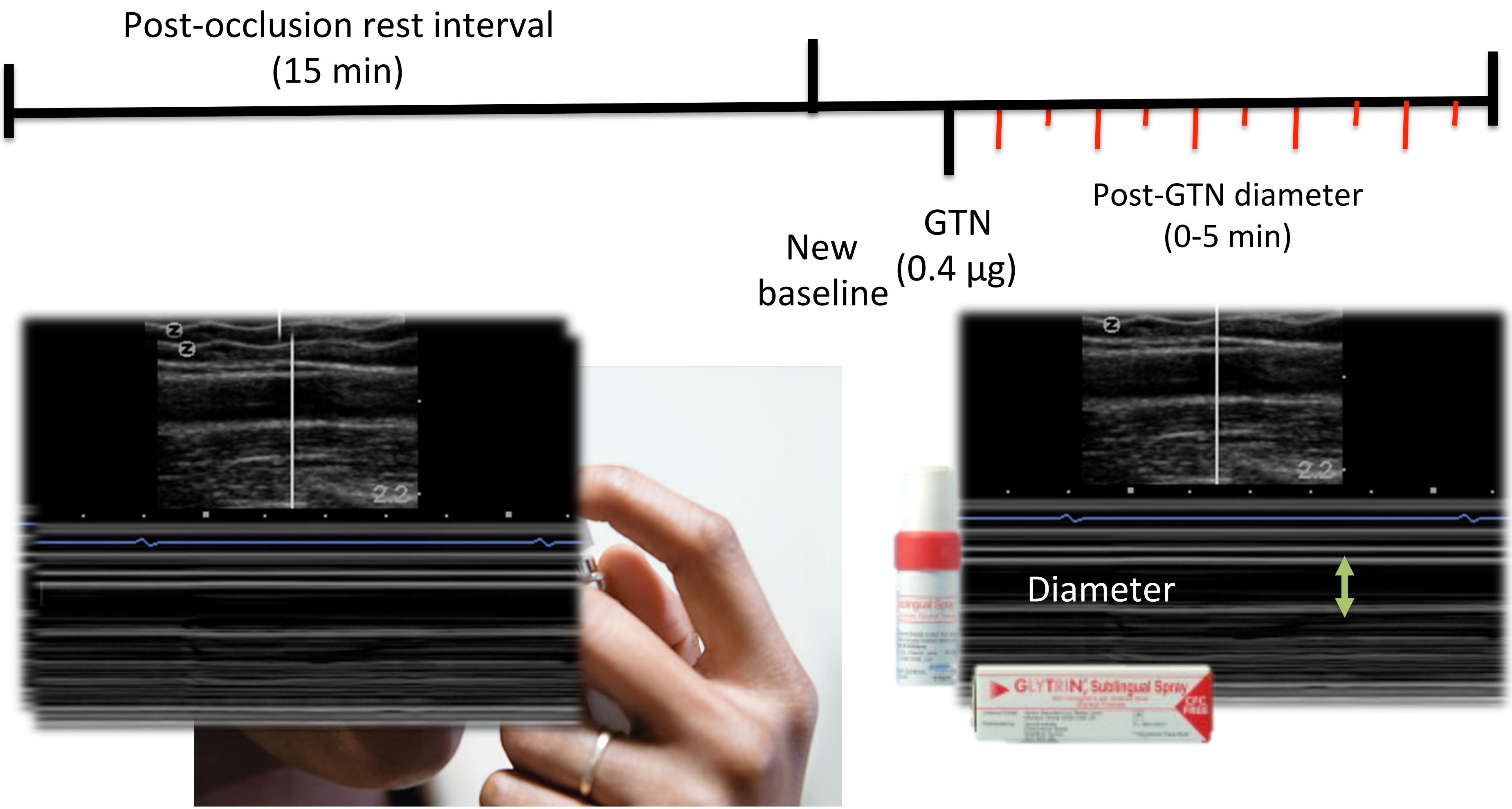
Endothelial Dependent Dilation







Endothelial Independent Dilation



Results

Physical Characteristics and Blood Pressure

	Group		
	Low CRF (n=14)	**Mod CRF (n=26)**	**High CRF (n=26)**
Age (y)	15.81 ± 0.65	15.67 ± 0.48	15.84 ± 0.46
Height (cm)	180.01 ± 5.48	176.36 ± 5.19 *	172.75 ± 6.09‡[a]
Weight (kg)	86.86 ± 27.20	67.54 ± 10.58 ‡	63.26 ± 7.65‡
BMI	26.88 ± 7.43	21.69 ± 3.11 ‡	21.17 ± 2.10‡
Waist Hip Ratio	0.89 ± 0.06	0.90± 0.04	0.98± 0.19 *[a]
SBP (mmHg)	135.88 ±14.77	122.04 ± 6.28 ‡	113.81± 6.25 ‡ [b]
DBP (mmHg)	83.13 ± 6.88	75.96 ± 4.37 ‡	75.00 ± 4.66 ‡
Tanner Stage (I-V)	3.23 ±1.09	4.00 ±0.59 †	4.04± 0.86 †

Values are means ± SD

*p < 0.05 vs. Low CRF; †p < 0.01 vs. Low CRF; ‡p < 0.001vs. Low CRF
a < 0.05 vs. Mod CRF; b < 0.01 vs. Mod CRF; c < 0.001 vs. Mod CRF

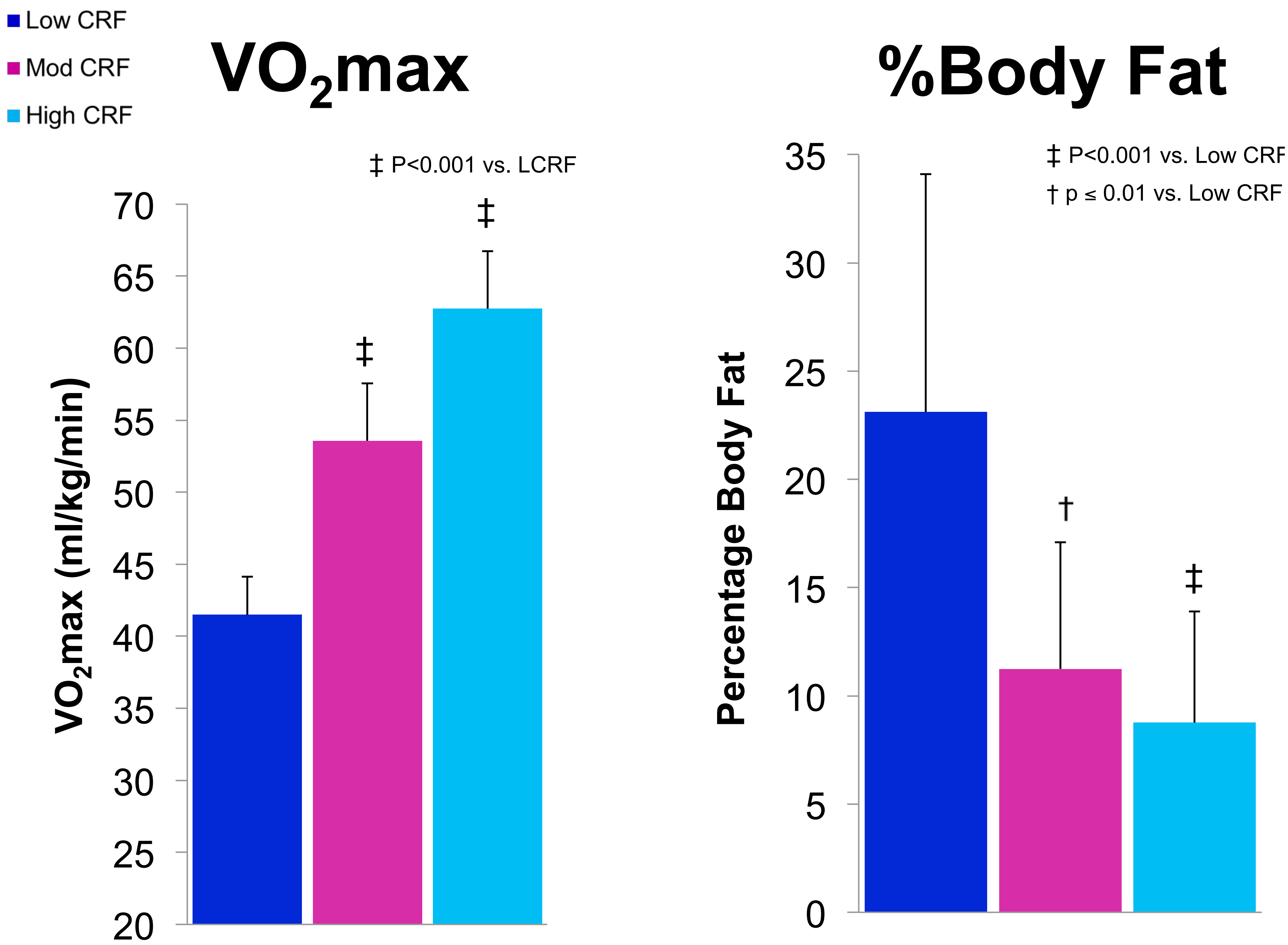
Results

Blood Lipids and Glucose

	Group		
	Low CRF	Mod CRF	High CRF
Triglycerides (mmol/L)	1.41 ± 0.87	0.63 ± 0.19 ‡	0.61 ± 0.20 ‡
Total cholesterol (mmol/L)	3.88 ± 0.71	3.21 ± 0.75	3.50 ± 0.82
LDL- C(mmol/L)	2.35 ± 0.63	1.82 ± 0.53 [a]	2.04 ± 0.65 *
HDL-C (mmol/L)	1.01± 0.27	1.02 ± 0.22	1.14 ± 0.31
Non HDL-C (mmol/L)	2.87 ± 0.62	2.19 ± 0.60 †	2.36 ± 0.66
Glucose (mmol/L)	4.56 ± 0.34	4.32 ± 0.26	4.35 ± 0.40

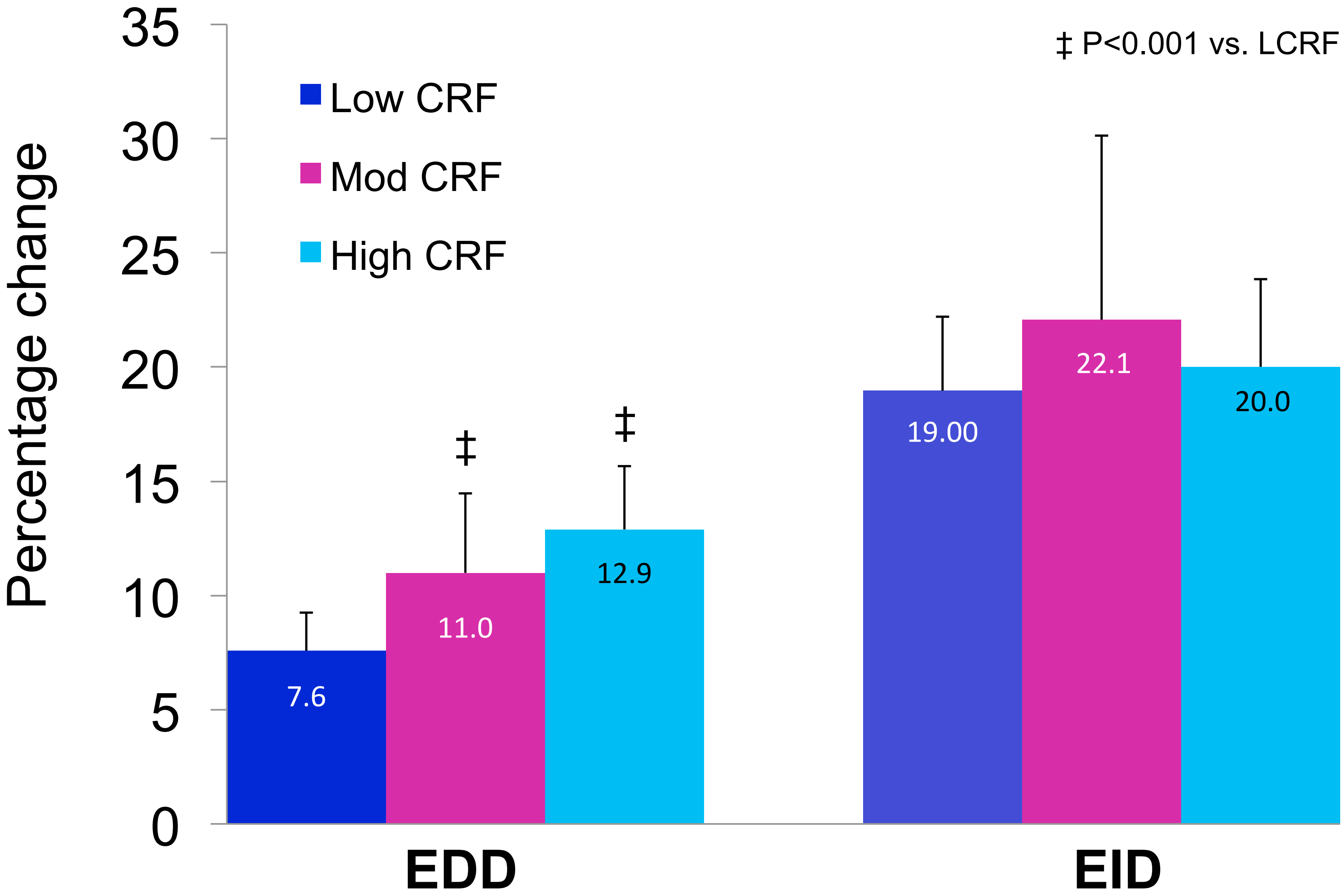
Values are means ± SD

*p < 0.05 vs. Low CRF; †p < 0.01 vs. Low CRF; ‡p < 0.001vs. Low CRF
a < 0.05 vs. Mod CRF; b < 0.01 vs. Mod CRF; c < 0.001 vs. Mod CRF

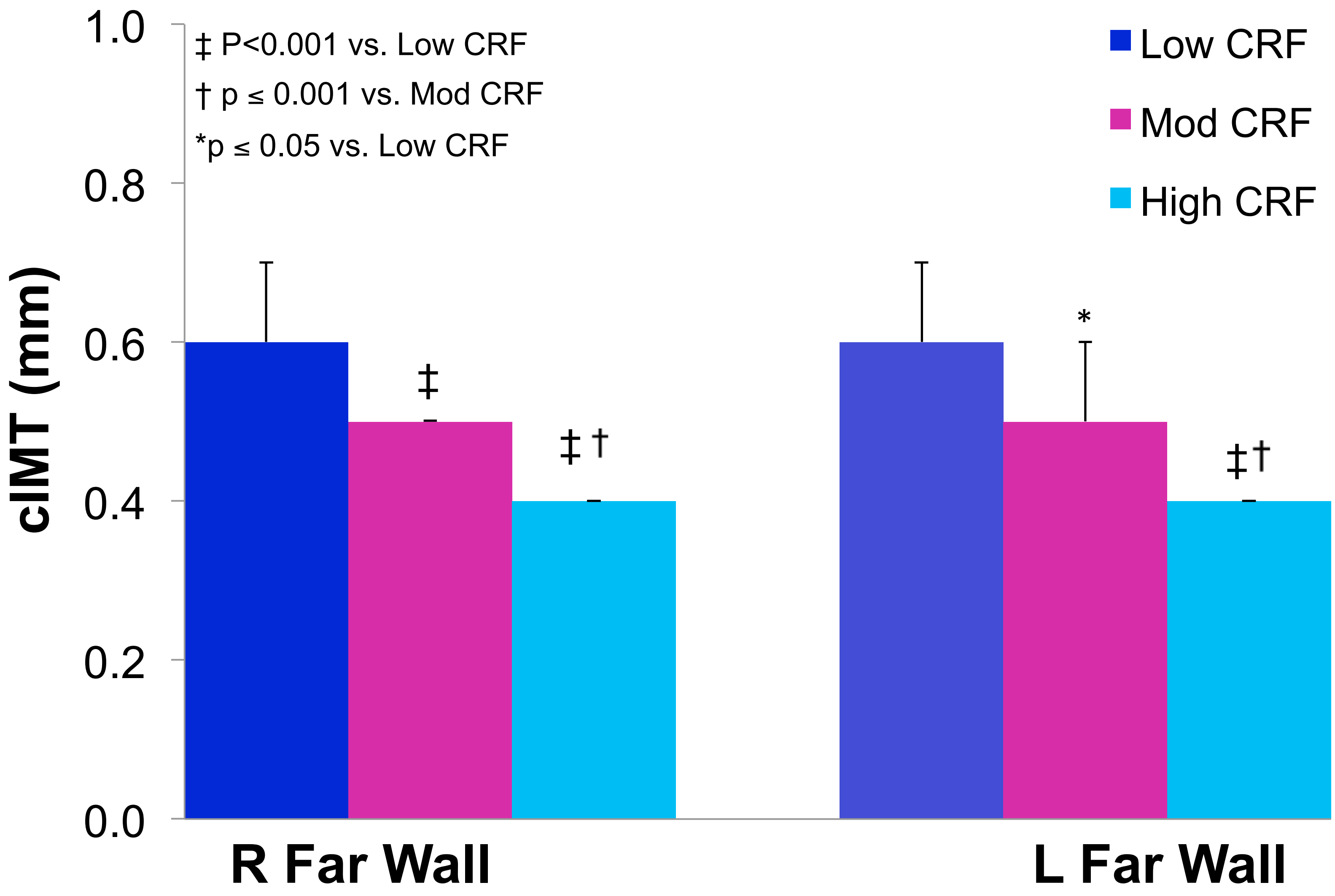


Low CRF
Mod CRF
High CRF
VO2max
‡ P<0.001 vs. LCRF
VO2max (ml/kg/min)
70
65
60
55
50
45
40
35
30
25
20
‡
‡
%Body Fat
‡ P<0.001 vs. Low CRF
† p ≤ 0.01 vs. Low CRF
Percentage Body Fat
35
30
25
20
15
10
5
0
†
‡

Endothelial Function

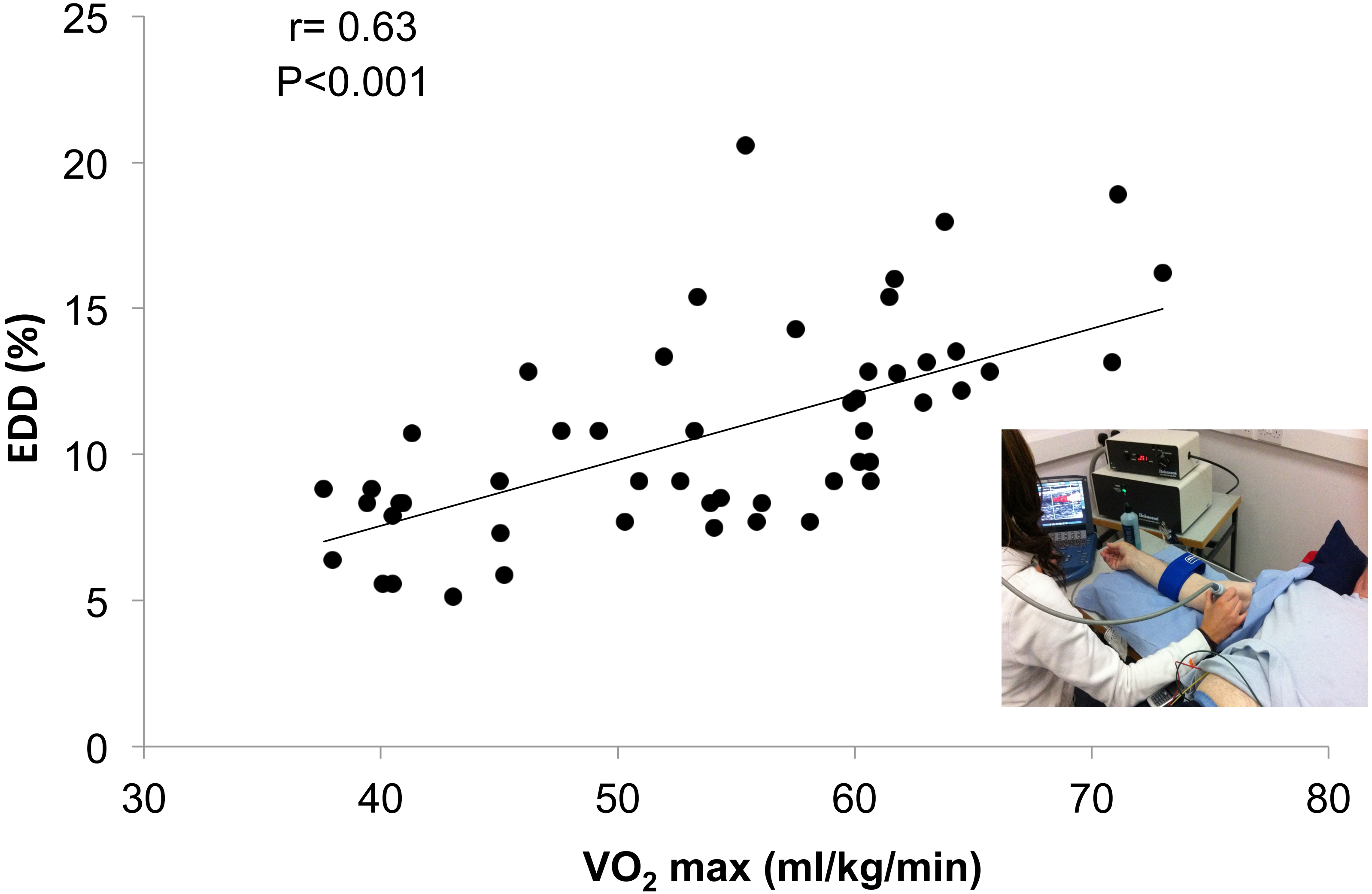


cIMT

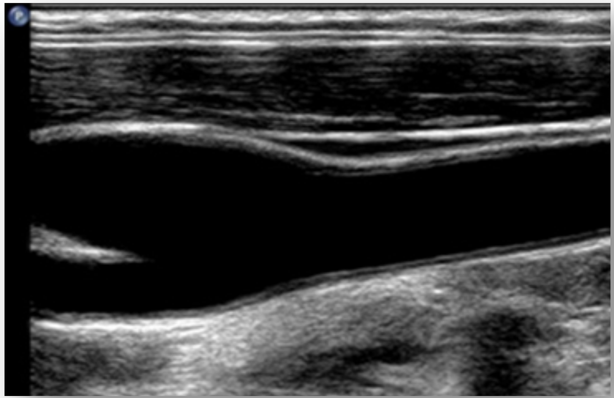


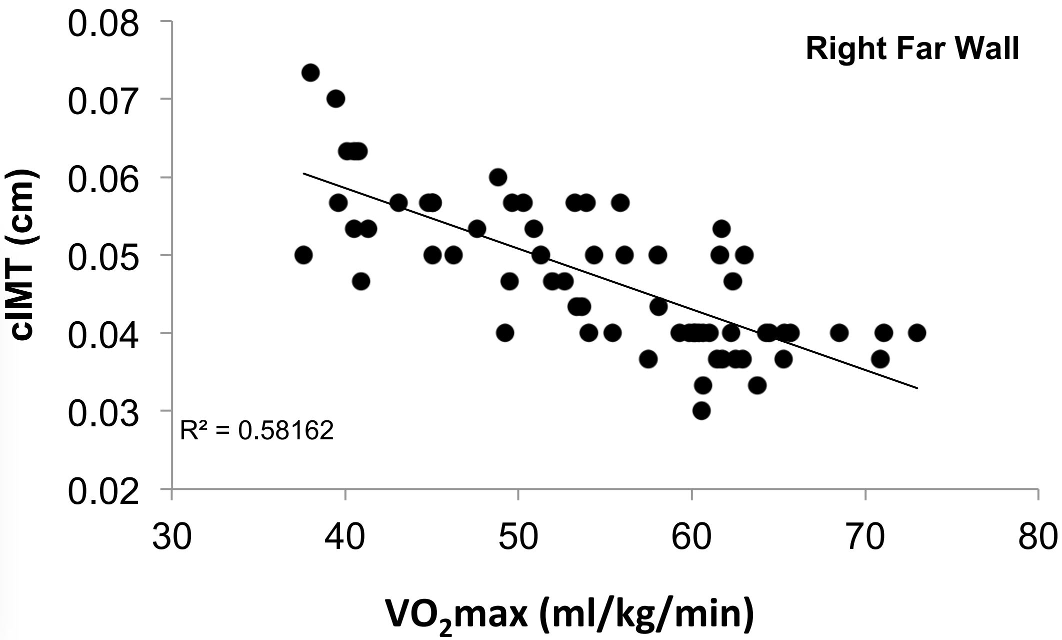
‡ P<0.001 vs. Low CRF
† p ≤ 0.001 vs. Mod CRF
*p ≤ 0.05 vs. Low CRF
Low CRF
Mod CRF
High CRF
cIMT (mm)
1.0
0.8
0.6
0.4
0.2
0.0
‡
‡ †
*
‡†
R Far Wall
L Far Wall

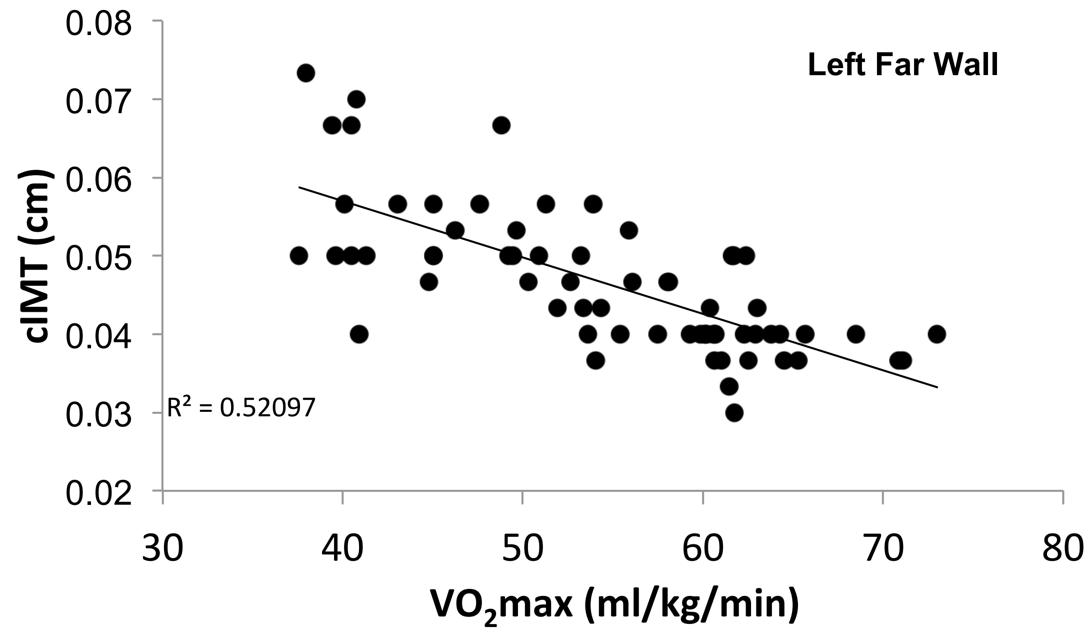
VO_2max and Endothelial Dependent Dilation



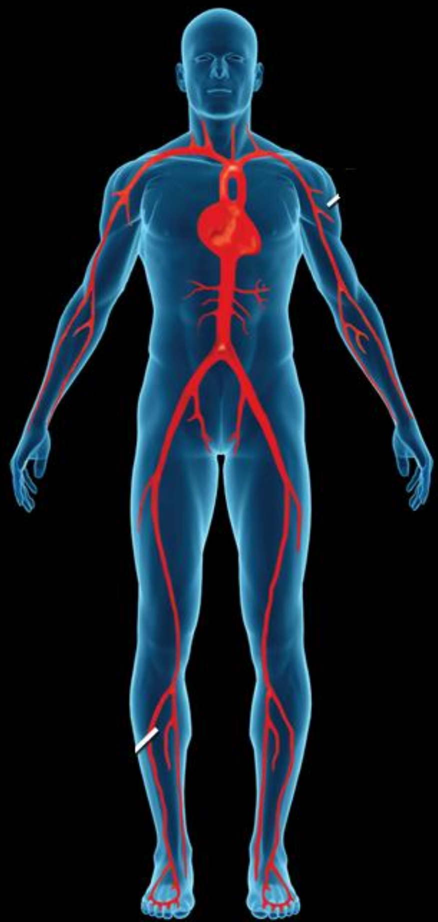
cIMT
Results







Conclusion



- BMI, BP, TG, LDL-C were higher in Low CRF than Mod and High CRF
- VO_2max was 25% and 41% higher in the Mod and High CRF than Low CRF, respectively
- EF was reduced in Low CRF compared to Mod and High CRF
- Positive relation between VO_2 and EF
- R and L Far Wall cIMT was higher in Low CRF than Mod and High CRF
- Positive relation between VO_2max and EF ($r=0.63$)
- Inverse relation between VO_2max and R ($r=0.72$) and L (0.76)Far Wall cIMT