

# Cardiovascular Rehabilitation in Different Pathologies

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# Cardiovascular Rehabilitation

- Coronary artery disease
- Peripheral vascular disease
- Hypertension
- Dyslipemia
- Obesity

# Benefits of Rehabilitation in CAD

- Lower mortality and/or greater survival
- Lower incidence of sudden cardiac death
- Incidence of re-infarction decreases
- Symptoms and the use of drugs decrease

O'CONNOR (1989) 25%

Handwetch (2001) 27%

# REHABILITATION AFTER MYOCARDIAL INFARCTION

## META-ANALYSIS OF 22 RANDOMIZED STUDIES

END POINT	EXERCISE AND OTHER INTERVENTIONS*			ONLY EXERCISE EJERCICIO		
	n	OR	95% CI	n	OR	95% CI
<b>TOTAL MORTALITY</b>						
1 year	14	0.67	0.47-0.96	6	0.93	0.62-1.39
> = 3 years	15	0.79	0.62-1.01	6	0.81	0.60-1.10
<b>CV MORTALITY</b>						
1 year	14	0.68	0.57-1.03	5	0.98	0.61-1.59
>= 3 years	15	0.74	0.57-0.96	5	0.85	0.59-1.22
<b>FATAL AMI</b>						
1 year	14	0.67	0.46-0.97	3	0.70	0.33-1.47
>= 3 years	14	0.75	0.57-0.99	4	0.73	0.44-1.19

\*Diet-quitting smoking-reduction of stress

O'Connor et al.Circulation 1989

# Physiologic Benefits of Exercise

- Improvement of endothelial dysfunction.
- Improvement of fibrinolytic and platelet systems
- Improvement of autonomic function
- Improvement of oxygen consumption

# Benefits of Exercise

- Improvement of coronary flow
- Improvement of demand
- Improvement of coronary risk factors
- Improvement of quality of life and stress

# Cardiovascular Rehabilitation

## GOAL:

Exercise as a drug in its exact dose.

MINIMIZE RISKS  
MAXIMIZE BENEFITS

# Cardiovascular Rehabilitation

Risk of heart arrest or SCD:  
1 each 60,000 to 100,000 people /  
hour in cardiac patients

Van Camp and Peterson,  
JAMA 1986



# Initial Medical Evaluation

- 1) Clinical background
- 2) 12 lead ergometer test
- 3) Risk stratification

# **Risk Stratification Usefulness**

- Determining risk of morbi-mortality
- Determining type and duration of medical supervision and cardiac monitoring
- Determining the type, level, and intensity of the exercise program

# **Risk Stratification**

## **Variables to consider**

- Functional capacity
- Ventricular function
- Ventricular arrhythmias
- Ischemia during exercise
- Age

# Risk stratification

American Association of Cardiovascular and Pulmonary  
Rehabilitation

## LOW RISK

- Normal ventricular function (LVEF > 50%)
- Freedom from complex arrhythmias in rest or exertion
- Non-complicated infarction, coronary surgery, or PTCA: freedom from symptoms or signs indicating ischemia
- Normal hemodynamic response to exercise
- Freedom from symptoms including angina during exertion and recovery
- Ergometer functional capacity > or = 7 METS
- Freedom from significant clinical depression

***Low risk is assumed when all low risk criteria are present***

# Risk Stratification

American Association of Cardiovascular and Pulmonary Rehabilitation

## INTERMEDIARY RISK

- Moderate left ventricular dysfunction
- LVEF 40 – 49%
- Signs or symptoms of ischemia (including angina) at median levels of exercise (5 – 6.9 METS) or in recovery

***Moderate risk is assumed for patients that do not meet high or low risk criteria***

# Risk Stratification

American Association of Cardiovascular and Pulmonary  
Rehabilitation

## HIGH RISK

- Severe left ventricular dysfunction (LVEF <40%)
- History of cardiorespiratory arrest or sudden cardiac death
- Complex ventricular arrhythmias in rest or exertion
- Infarction or cardiac surgery complicated with cardiogenic shock, heart failure, or signs and/or symptoms of ischemia
- Abnormal hemodynamic response to exercise (fall of systolic pressure or chronotropic incompetence)
- Signs or symptoms of ischemia (including angina) at low levels of exercise (< 5 METS) or in recovery
- Ergometer functional capacity < 5 METS
- Significant clinical depression

***High risk is assumed when at least one of the high risk criteria is present***

# Entrance to the Plan

- Once risk is classified
- Indication of exercise

# Rehabilitation Modality

- Low risk patients may perform the Rehabilitation program at home (ideally, in Health Care Centers), not requiring strict cardiological surveillance, but control of risk factors, change in diet habits, and a program of physical training.
- Patients in moderate and high risk should conduct the programs in hospitals or specialized centers, controlled by qualified staff. In individuals considered in high risk, electrocardiographic monitoring is recommended during training.



# Low risk

- What was described in the previous lecture

# Moderate to High Risk

- 1 Exercise is planned at a very low intensity
- 2 It is planned at a very low intensity and low duration and a high frequency of sessions
- 3 It is recommended to work at an intensity of a heart rate of 10 beats below the ischemic threshold (ST depression or angor)
- 4 Strength exercise should be made carefully
- Re-evaluations should be made each 4 weeks and progression or regression of physical activity is evaluated

# Peripheral Vascular Disease

- Peripheral vascular disease is defined as arm-ankle index lower than 9
- The diagnosis is clinical and by vascular Echo Doppler
- Evaluation of functional capacity
- Treatment

# Peripheral Arteriopathy: Benefits of Exercise

- Formation of collateral vessels (only in experimental model studies)
- Improvement in vasodilation depending on the endothelium
- Improvement in hemorheology
- Improvement in muscular metabolism (greater maximal oxygen consumption)
- Improvement in walk efficiency (potency in biomechanical performance)

# Benefits of Exercise

- Rehabilitation improves survival of patients with peripheral vascular disease

# Entrance to an Exercise Plan

- Rule out coronary artery disease
- Control of coronary risk factors
- Evaluate functional capacity
  - 6-minute walk
  - Ergometer test

# Entrance to an Exercise Plan

- Ergometer Test
  - 1 To rule out coronary artery disease
  - 2 To evaluate functional capacity and indicate exercise

# Entrance to an Exercise Plan

## Ergometer Test

- Treadmill is used
- Constant or incremental protocols
- The distance walked is analyzed at the onset of claudication and the distance walked up to the maximal level of pain



# Peripheral Arteriopathy: Indication of Exercise

- Frequency
- Exercise in treadmill or in walking lane, should be made 3 to 5 times per week

# Peripheral Arteriopathy

## Intensity

- The initial load in treadmill should have a velocity and degree of slope such that would originate claudication at 3-5 minutes. In the case of a walking lane, we use velocity-distance until the appearance of claudication at 3-5 minutes
- The patient walks with the established load until it causes pain (claudication) of moderate severity, followed by a brief period of rest standing or sitting, until allowing symptoms to be solved

# Peripheral Arteriopathy

## Duration

- The exercise-rest-exercise pattern should be repeated throughout the session
- The initial duration usually includes 35 minutes of intermittent walks, which are increased 5 minutes per session until 50 minutes are reached

# Peripheral Arteriopathy

## Modality

- Walk until pain appears. It should be stopped, and when the pain subsides, it should continue with a new session
- Walk until the pain is close to maximal
- Walk until the pain reaches a moderate severity

# Peripheral Arteriopathy

## Types of exercise

- Treadmill or walking lane to walk are the most effective options for rehabilitation exercises in claudication.
- Resistance exercises may yield individual benefits as in other cardiovascular diseases, and in this case, they are **supplementary** but do not substitute walking. They are generally well tolerated, as fitness.

# Peripheral Arteriopathy

- In a meta-analysis of Gardner and Poehlman the great improvement in walking occurs when each exercise session has a minimal 30 minutes, is made 3 times per week; the walking modality is used until pain is close to maximal and when the program lasts 6 months at least or more.

# Peripheral Arteriopathy

- While the patient improves his capacity to walk, loads of exercises should be increased in degree or velocity or both, in such a way that they always ensure a stimulus of pain by claudication during sessions
- While the patient improves his/her capacity to walk, there is a chance that cardiac signs or symptoms may appear (e.g.: arrhythmias, angina, or ST segment depression), events that should cause a re-evaluation of the patient.

# Exercise in Coronary Risk Factors

- The indication of exercise in coronary risk factors follow the same guidelines already described:
  - Clinical history
  - Ergometer test
  - Risk evaluation



# Dyslipidemia

- Aerobic exercise indicated:
  - HDL increases between 8 and 22%
  - TG decreases between 20 and 40%
  - Small LDL particles decrease
  - No changes occur in total cholesterol, unless body fat decreases.

At 20 weeks of training

# Dyslipidemia

- Strength exercise indicated:
  - It decreases LDL and total cholesterol if total body fat decreases
  - It does not modify HDL or Triglycerides.

*Kokkinos et al Ulrich et al*

# Why Exercise Has Benefits on Dyslipidemia?

- It produces decrease of basal adrenergic tone
- It improves sensibility to insulin
- It stimulates lipidic metabolism
- Weight decreases

# Indication of Exercise in Weight Lifting

- Frequency: 3 to 5 times per week
- Intensity 70% of  $MVO_2$
- Duration: 1 hour
- Modality: Aerobic and strength
- Progression: Increase in duration and intensity until reaching maintenance
- In 3 months the effects are observed

# Arterial Hypertension

- Indicated physical exercise:
  - Systolic basal BP decreases between 10 to 8 mm (in average)
  - Diastolic basal BP decreases between 7 and 8 mm (in average)
  - Intra-exertion BP decreases
  - The risk of developing HTN is reduced in normotensive patients

# Why Physical Activity Improves Blood Pressure?

- The training effect generates:
  - Reduction of adrenergic tone
  - Increase of sensibility to insulin
  - Decrease of renin-angiotensin-aldosterone system levels
  - Improvement of endothelial dysfunction
  - Increase of taurine

# Indication of Exercise in HTN

- Frequency: 3 a 5 times per week
- Intensity: 50 to 60% of  $MVO_2$
- Duration: 60 minutes
- Modality: dancing, walking, swimming, treadmill
- Progression: each 12 weeks
- Strength: 40 to 50% of maximal resistance and many repetitions

# Indication of Exercise in HTN

- Strength exercises are not contraindicated; we just have to avoid the “Valsalva” effect during training
- Strength exercises improve muscular mass, muscular strength, and bone mass



# Obesity

- Evaluate body composition
- Evaluate the locomotive system
- Perform aerobic tests
  - In field
  - Ergometer in treadmill
- Nutritional evaluation and diet habits

# Obesity

- Aerobic physical activity will increase calorie consumption
- Muscle building activity will increase muscular mass and thus, metabolic output in the long term.

# Indication of Exercise in Obesity

- Frequency: 5 to 6 times per week.
- Intensity: 50% (low).
- Duration: 30 to 50 minutes.
- Modality: walking
- Progression: increase
  - 1st volume: frequency and duration
  - 2nd intensity: mild increase
  - 3rd muscle: muscle exercises

**Thank you very much!**