71° Congresso Nazionale della Società Italiana di Cardiologia
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Physical exercise and cardiovascular therapy

Physical exercise as therapeutic option in arterial hypertension

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Initiation of antihypertensive treatment

2007 ESH ESC Hypertension Guidelines
J Hypertens 2007;25:1105–1187

Blood pressure (mmHg)					
Other risk factors OD or disease	Normal SBP 120–129 or DBP 80–84	High normal SBP 130–139 or DBP 85–89	Grade 1 HT SBP 140–159 or DBP 90–99	Grade 2 HT SBP 160–179 or DBP 100–109	Grade 3 HT SBP ≥180 or DBP ≥110
No other risk factors	No BP intervention	No BP intervention	Lifestyle changes for several months then drug treatment if BP uncontrolled	Lifestyle changes for several weeks then drug treatment if BP uncontrolled	Lifestyle changes + Immediate drug treatment
1–2 risk factors	Lifestyle changes	Lifestyle changes	Lifestyle changes for several weeks then drug treatment if BP uncontrolled	Lifestyle changes for several weeks then drug treatment if BP uncontrolled	Lifestyle changes + Immediate drug treatment
≥3 risk factors, MS or OD	Lifestyle changes	Lifestyle changes and consider drug treatment	Lifestyle changes + Drug treatment	Lifestyle changes + Drug treatment	Lifestyle changes + Immediate drug treatment
Diabetes	Lifestyle changes	Lifestyle changes + Drug treatment			
Established CV or renal disease	Lifestyle changes + Immediate drug treatment	Lifestyle changes + Immediate drug treatment	Lifestyle changes + Immediate drug treatment	Lifestyle changes + Immediate drug treatment	Lifestyle changes + Immediate drug treatment

- Lack of physical fitness is a strong predictor of cardiovascular mortality independent of blood pressure and other risk factors
- Aerobic exercise is any activity that uses large muscle groups, maintained continuously, rhythmic in nature.
- Dynamic resistance is when a body part moves against this force during contraction
- Isometric resistance is when a contraction is not followed by movement

EFFECTS OF EXERCISE ON BLOOD PRESSURE

Dynamic exercise

- BP increases in proportion to the intensity of the effort
- During longterm stable exercise, BP tends to decrease after an initial increase of short duration greater for systolic with slightly increased or unchanged diastolic
- For the same oxygen consumption, the rise is more pronounced in older subjects and when exercise is performed with smaller than with larger muscle groups
- Acute exercise is followed by post-exercise hypotension, which may last for several hours and is more pronounced and of longer duration in hypertensives than in normotensives

Static exercise

- BP increases during acute static exercise and the increase is more pronounced than with dynamic exercise, particularly with heavy static exercise at an intensity of >40-50% of maximal voluntary contraction

- **Value and limitations of graded exercise testing in predicting future hypertension**
- **Role of acute and chronic endurance and resistance exercise on blood pressure**
- **Exercise prescription recommendations and special considerations for individuals with hypertension**
- **Potential physiologic mechanisms for the BP-lowering effects of acute and chronic exercise**

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Mechanisms of exaggerated BP response

- Total peripheral resistance does not fall adequately to compensate for the rise in cardiac output during exercise
- Increased peripheral vascular resistance and impaired capacity for exercise-induced vasodilatation
- Responses explained by:

  - hyper-reactivity of sympathetic nerves and an increased vascular response to adrenergic stimulation

  - thickening of the arteriolar wall that alters its ability to respond to vasonconstrictor stimuli

Prediction of future hypertension

- Exercise tests and the definition of an exaggerated BP response were not standardized accross the various studies

- Noninvasive BP measurements during exercise have inherent limitations, particularly with regard to diastolic

- When exercise testing is performed for other reasons, BP measurement may provide useful prognostic information

Prediction of CV complications

- The prognostic importance of exercise BP depends on the population studied, underlying clinical status and hemodynamic response
- A worse prognosis is associated with a hypertensive response in healthy subjects
- A worse prognosis is associated with an hypotensive response in patients with CV and heart failure (variability in hypertensive patients depending on cardiac output)

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Effect of endurance training on blood pressure, and regulating mechanisms

Cornelissen VA, Fagard RH Hypertension 2005, 46:667-675

- Exercise reduced resting systolic blood pressure by 3 mmHg and resting diastolic blood pressure by 2 mmHg
- In adult with hypertension reduces systolic pressure by about 7 mmHg and diastolic pressure by about 5 mmHg
- Aerobic training reduces vascular resistance through a 7,1% reduction in vascular resistance, a 29% reduction in plasma norepinephrine and 20% reduction in plasma renin activity

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Exercise prescription

Position stand - American College of Sports Medicine 2004

Frequency: on most, preferably all, days of the week

Intensity: moderate intensity (40-<60% of VO_2R)

Time: ->30 min of continuous or accumulated physical activity per day

Type: primarily endurance physical activity supplemented by resistance exercise

Resistance or muscle-strengthening exercises

Physical Activity Guidelines Advisory Committee Report 2008 - US Department of Health and Human Services

- Progressive muscle strengthening exercises that target all major muscle groups performed on 2 or more days per week
- 8 to 12 repetitions of each exercise should be performed to volitional fatigue
- One set is effective; however ,limited evidence suggests that 2 or 3 sets may be more effective

Walk, run or swin?

Jennings GL J.Hypert 1997, 15:567-569

- Moderate level of exercise lowered blood pressure, but this type of training reduced body weight, body fat and waist circumference
- Increased insulin sensitivity and HDL-cholesterol levels
- The type of exercise should be primarily endurance physical activity (walking, jogging,swimming) supplemented by resistance exercise

Exercise recommendations

- For person with high BP, an exercise program that is primarily aerobic-based is recommended
- Resistance training should serve as an adjunct to an aerobic-based program
- The evidence is limited regarding frequency, intensity, time and type recommendations
- Limited evidence exists regarding special considerations for those with hypertension

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- **Potential physiologic mechanisms for the BP-lowering effects of acute and chronic exercise**

Neurohumoral adaptation

- Elevated sympathetic nerve activity has been associated with increases in arterial wall thickening, training-induced decreases may be beneficial in preventing vascular remodeling
- Exercise training does not consistently reduce plasma renin and angiotensin II levels and RAAS does not appreciably contribute to the lowering of BP after training
- Vascular adaptations are likely to contribute to lower BP after training, exercise training alters the vascular responsiveness to two potent vasoconstrictors norepinephrine and endothelin-1
- Training-induced vascular remodeling may contribute to the anthypertensive effect of exercise
- Genetic component to BP adaptations to exercise training