DEFINITION

• Resting systolic blood pressure $\geq 140$ mm hg and/or diastolic blood pressure $\geq 90$

• Taking anti-hypertensive medication

• Has been told by a physician on at least 2 occasions that their blood pressure is high

• Blood pressure that is higher than normal
DEFINITION

• The blood exerts a greater than normal force against inner walls of blood vessels

• This excess force in time can permanently damage organs, most often the heart, brain, kidneys, and eyes
VIDEO

- Do You Have High Blood Pressure?
EPIDEMIOLOGY

• Data from NHANES 2005-2008 indicates that 33.5% of US adults ≥ 20 years have hypertension

• 76,400,000 US adults with hypertension

• 1 in every 3 US adults has high blood pressure.

• Prevalence is nearly equal between men & women

• African American adults have highest rates of hypertension in the world at 44%
EPIDEMIOLOGY

• Among hypertensive adults, ~80% are aware of their condition, 71% are using antihypertensive medication & only 48% of those aware are controlling their condition.

• Estimated cost in America in 2008: 50.6 billion dollars

• Data from NHANES from 1988-1994 & 2007-2008 showed improvement of control rates from 27.3% to 50.1%, treatment from 54% to 73.5% and control/treatment rates from 50.6% to 72.3%
EPIDEMIOLOGY

- Projections show that by 2030, an additional 27 million people could have hypertension; a 9.9% increase in prevalence from 2010.
RISK FACTORS

- Age
- Ethnicity
- Family history
- Genetic factors
- Lower education & socioeconomic status
- High weight
- Low physical activity
- Tobacco use

- Psychosocial stressors
- Sleep apnea
- Dietary factors such as:
  - Dietary fats
  - High sodium intake
  - Low potassium intake
  - Excessive alcohol intake
<table>
<thead>
<tr>
<th>BP Classification</th>
<th>SBP mmHg</th>
<th>DBP mmHg</th>
<th>Lifestyle Modification</th>
<th>Initial Drug Therapy Without Compelling Indication</th>
<th>Initial Drug Therapy With Compelling Indication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>&lt; 120</td>
<td>and &lt;80</td>
<td>Encourage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prehypertension</td>
<td>120-139</td>
<td>or 80-89</td>
<td>Yes</td>
<td>Antihypertensive drugs indicated</td>
<td>Drugs for compelling indications</td>
</tr>
<tr>
<td>Stage 1 hypertension</td>
<td>140-159</td>
<td>or 90-99</td>
<td>Yes</td>
<td>Antihypertensive drugs indicated</td>
<td>Drugs for compelling indications. Other antihypertensive drugs as needed</td>
</tr>
<tr>
<td>Stage 2 hypertension</td>
<td>≥ 160</td>
<td>or ≥ 100</td>
<td>Yes</td>
<td>Antihypertensive drugs indicated</td>
<td>Two drug combination for most.</td>
</tr>
</tbody>
</table>
CAUSE

• The underlying cause of hypertension is not known in 90% of the cases.

• In 5-10% of the rest of the cases, hypertension is secondary to a variety of known diseases such as chronic kidney disease.

• Some known causes include sleep apnea, drug induced causes, chronic kidney disease, renovascular disease, chronic steroid therapy, and thyroid or parathyroid disease.
SYMPTOMS

• “Silent killer”
  • Usually no symptoms until it reaches an advanced state

• When a severe stage is reached, strenuous exercise and other forms of stress may cause:
  • Headache
  • Visual disturbances
  • Vomiting
  • Convulsions

• It may continue to be asymptomatic
LABORATORY DIAGNOSIS TESTS

- Most people are not aware they have hypertension until they have a routine medical check up with their physician because lack of symptoms
COMPLICATIONS

• Hypertension imposes an afterload on the heart, resulting in increased left ventricular wall thickness & reduced early diastolic filling
  • There is a strong correlation between left ventricular mass and CVD morbidity.

• Duration of hypertension promotes the presence & extent of coronary calcium which is a potential predictor of sudden coronary death
COMPLICATIONS

• Hypertension is also associated with impaired cognitive function & a thickening & stiffening of medium & small blood vessels
  • Can also lead to retinopathy & nephropathy
TREATMENT WITH MEDICATION

• Beta-blockers: mandatory as part of therapy for heart failure due to systolic dysfunction (can be used in combination with diuretics)

• Alpha and Beta adrenergic blocking agents

• Central alpha 2 agonists & other centrally acting drugs (can be used in combination with diuretics)

• Calcium channel blockers (nondihydropyridines & dihydropyridines)
TREATMENT WITH MEDICATION

• Direct peripheral vasodilators

• Angiotensin: converting enzyme (ACE) inhibitors (can be used in combination with diuretics)

• Most patients need at least 2 medications to achieve targeted blood pressure levels
TREATMENT WITH LIFESTYLE MODIFICATIONS

• Lose weight if overweight
• Limit alcohol intake
• Reduce sodium intake to less than 2.3 g/day
• Maintain adequate dietary potassium, calcium, & magnesium intake
• Perform aerobic physical activity for 30 min/day
• Eat diet rich in fruits, vegetables, low fat dairy products
• Reduce saturated fat & cholesterol
• Stop smoking
EFFECTS OF DISEASE ON EXERCISE

- Headaches, visual disturbances, vomiting, convulsions, chest paints, & discomfort

- In hypertensive people, normal blood pressure response to exercise are exaggerated

- Diastolic blood pressure may slightly rise as a result of impaired vasodilatory response
EFFECTS OF DISEASE ON EXERCISE

• Studies have documented a consistent 10 to 20 mm hg reduction in SBP 1-3 hours following exercise in those with hypertension

• Untreated hypertension may impair exercise tolerance, performance, or both.
EFFECTS OF MEDICATION ON EXERCISE

• If exercise test is nondiagnostic, individuals may take their prescribed meds at the recommended time. If test is diagnostic BP medication may be withheld before testing with physician approval.

• Beta-blockers can cause an attenuated HR response to exercise & reduced maximal exercise capacity

• Diuretic therapy may cause hypokalemia, cardiac dysrhythmias, or potentially a false-positive exercise test
EFFECTS OF MEDICATION ON EXERCISE

• Beta-blockers & diuretics may adversely affect thermoregulatory function & cause hypoglycemia

• Beta-blockers may reduce submaximal and maximal exercise capacity

• Anti-hypertensive meds may lead to sudden reductions in post exercise BP
EFFECTS OF BOUT OF EXERCISE ON PATIENT

• Exercise training lowers blood pressure at fixed submaximal workouts

• Aerobic activities are emphasized but can be supplemented with moderate resistance training
   • Aerobic responses are immediate (post exercise hypotension)

• If hypertension is untreated, there is usually some limitation in exercise tolerance
EFFECTS OF TRAINING ON DISEASE

- Aerobic exercise leads to reductions of 5 to 7 mm hg in those with hypertension

- Resistance training may favorably impact prevention and the progression of hypertension

- Endurance training can have an average reduction of 10 mm hg on SBP & DBP in those with stage I or II
EFFECTS OF TRAINING ON DISEASE

• Mechanisms by which exercise training lowers BP may include:
  • Decrease in plasma norepinephrine levels
  • Increase in circulating vasodilator substances
  • Improves hyperinsulinemia
  • Alteration in renal function

• Physically active persons with hypertension have lower mortality rates than those who are sedentary
EXERCISE TESTING

• Individuals with hypertension will be stratified into one of three risk groups depending on BP level & presence of other CVD risk factors

• Medical evaluation before exercise testing

• Those who plan to perform vigorous exercise (≥ 60% VO2R) should have a medically supervised symptom-limited exercise test
EXERCISE TESTING

• Persons in asymptomatic risk group A or B (BP<180/110) who want to engage in light or very light (<40% VO2R) to moderate (40-60% VO2R) a symptom limited GXT may not be necessary beyond routine medical evaluation

• Individuals in risk group C should have an exercise test before engaging in moderate exercise but testing is not necessary before engaging in light or very light intensity
EXERCISE TESTING

• Majority of patients with hypertension may begin moderate aerobic exercise training

• Resting SBP > 200 or DBP > 110 are contraindications to exercise testing

• Exercise test should generally be stopped with SBP > 250 or DBP > 115
EXERCISE TESTING

• Aerobic methods: cycle and treadmill tests
  • Measures HR, BP, rate-pressure product, RPE, respired gas analysis
  • Endpoints: serious dysrhythmias, >2 mm ST-segment depression or elevation, ischemic threshold, T-wave inversion with significant ST change, SBP > 250 or DBP > 115, headache or other significant symptoms, fatigue, VO2max
  • Medications should be taken at usual time relative to exercise session

• Strength: Free weights or machine 1 RM or maximal voluntary contraction
  • Observe for exaggerated pressor response
EXERCISE PRESCRIPTION

• Flexibility exercise should be performed after a thorough warm-up & during the cool down

• Frequency: aerobic exercise on most, preferably all days of the week; resistance exercise 2-3 days a week

• Intensity: moderate intensity aerobic exercise (40-60% VO2R) supplemented by resistance training at 60-80% of 1RM
EXERCISE PRESCRIPTION

• Time: 30-60 minutes per day of continuous or intermittent aerobic exercise.
  • If intermittent, use minimum of 10 minute bouts accumulated to total of 30-60 minutes
• Resistance training should consist of at least one set of 8-12 reps

• Type: Emphasis should be placed on aerobic activities such as walking, jogging, cycling, & swimming. Resistance training using machines or free weights.
EXERCISE PRESCRIPTION

- **Aerobic Goals:**
  - Control BP at rest and during exercise
  - Improve coronary artery disease risk factors
  - Increase VO2max and ventilatory threshold
  - Increase peak work and endurance
  - Increase caloric expenditure

- **Strength Goals:**
  - Increase Strength

- **Time to goal for each:** 4-6 months
SPECIAL CONSIDERATIONS

• Patients with severe or uncontrolled BP should add exercise training to their treatment plan only after evaluation from their physician & being prescribed antihypertensive medication

• If resting SBP >200 and/or DBP > 110, do not exercise

• Beta-blockers: reduce HR by ~30 contractions per minute
SPECIAL CONSIDERATIONS

• Alpha blockers, calcium channel blockers, and vasodilators may cause postexertional hypotension

• Exercise at 40-70% VO2 max appears to lower resting BP as much as, if not more than exercise at higher intensities
SUMMARY

- Hypertension is blood pressure that is higher than normal
- Hypertension leads to many severe heart problems and other conditions
- Those with hypertension are usually asymptomatic until it has reached an advanced stage
- Most people with hypertension can participate in moderate aerobic exercise
- Treatment can include medications and lifestyle changes
REFERENCES

• Sorace, P., Churilla, J. R., & Magyari, P. M. Resistance Training for Hypertension. ACSM'S Health & Fitness Journal, 16 (1), 13-17.
ANY QUESTIONS?