Physiology

sheet done by: Rasha Raka

Buthainah al masaeed
Hypertension: sustained elevation of BP

<table>
<thead>
<tr>
<th></th>
<th>Systolic arterial pressure</th>
<th>Diastolic arterial pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>normal radial artery BP in adults</td>
<td>100 - 140 mmHg</td>
<td>60 - 90 mmHg</td>
</tr>
<tr>
<td>Stage I hypertension</td>
<td>140 - 159 mmHg</td>
<td>90 - 99 mmHg</td>
</tr>
<tr>
<td>Stage II hypertension</td>
<td>≥160 mmHg</td>
<td>≥ 100 mmHg</td>
</tr>
</tbody>
</table>

BP = TPR * CO
Where, BP: blood pressure; TPR: Total peripheral resistance; CO: cardiac output.
Where, CO = SV * HR
SV: stroke volume; HR: Heart rate.

Types of hypertension:
1. Essential (primary) HTN: 95% of people
   it is idiopathic: When know its reason but we can’t treat it, and the reason is mainly atherosclerosis
   ➔ Peripheral resistance.
   In reality the problem is probably multi-factorial. Genetic factors and environmental factors including high salt intake, heavy consumption of alcohol, obesity, and impaired intra-uterine growth.
2. Secondary HTN: 5-10% of people
   its reason is treatable
   a consequence of a specific disease or abnormality leading to Na retention (↑ volume) and/or peripheral vasoconstriction (↑ Peripheral resistance)

Note:
Never diagnose a patient immediately with essential HTN even if he was an old person (>40 years old)
we should do investigation, if we find a cause that is treatable so it is secondary, and vice versa.

**Risk factors:**
1-Fixed: can’t be changed
   - Age, Sex, Family history
2-Variables: can change and we can control them
   - Obesity, smoking, Diabetes mellitus, high cholesterol

**The possible causes:**
A. Alcohol: alcohol is vasodilator, in foreign countries they use it in small quantities ( ) but in large quantities it causes HTN (alcoholism)
B. Pregnancy: Pre-eclampsia /eclampsia: pregnancy specific syndrome with elevated blood pressure that occurs after the first 20 weeks of pregnancy and accompanied by protein-urea and edema. We don’t know the exact cause, but it’s an autoimmune disease, that is resolved after delivery.
C. Renal diseases: Renal vascular disease (renal artery stenosis) and kidney diseases
   - Renal artery stenosis decreases renal perfusion (flow to the kidney). This means less volume, and macula densa will secret more renin, this will elevate the level of angiotensin, which increases BP.
   - If 2 renal arteries had stenosis the P increase more.
D-Co-arctation of aorta
   - It’s stenosis of descending aorta (congenital disease), and it has the same effect of the 2 renal arteries stenosis. It causes increase in P in upper part of the body, and decrease in P in lower part of the body.
Diagnosis: should be early in the life of the baby, to prevent HF in few years.
   - It’s done by measuring P and pulsation of upper limbs and lower limbs.
   - If the pressure and pulsation are high in upper limb, and low in lower limb, then we should put a balloon to dilate the aorta with stenosis.
E. Endocrine diseases:
1. Phaeochromocytoma: It is mostly benign tumor of the adrenal medulla with increase secretion of epinephrine and nor-epinephrine, so it causes paroxysmal hypertension but may be persist. These 2 hormones are released in case of sympathetic stimulation, and they cause vasoconstriction so they will increase the peripheral resistance, and cause HTN.

2. Cushing syndrome: elevated level of cortisol has mineralocorticoid effect.
   What’s happening here that the level of cortisol is increased so the level of cholesterol increases, and cause HTN. The patient has a chubby face but he isn’t obese.
3. Primary hyperaldosteronism (Conn's syndrome).
4. Thyrotoxicosis: high thyroid hormone associated with increase in systolic pressure due to increase activity of the heart (increase stroke volume and heart rate) and decrease diastolic pressure due to vasodilatation. It’s related to metabolism.

F. Drugs: example oral contraceptives containing estrogen, corticosteroids
   Contraceptives should be stopped after 3 to 4 months for a bout 2 months.

Note:
- some people have white syndrome so we have to be careful with the patient and took to him about everything except the medical thing 😊
- Also we have to reputeing the test at least 3-4 time to make sure.
- Any doctor need to check on two impotent thing the pulsation and the blood pressure.

Clinical findings and diagnosis Investigations:
1-General General urine examination (for old patient have HTN)
   • Urea and electrolytes check the function of the kidney
   • FBP (diabetes or not) fasting blood pressure
   • Creatinine
   • ECG
   • Echocardiogram (size and contractible of myocardial)
   • Lipid profile
   • Chest x-ray (the heart is dilated or not)

2-Specific investigations (we don’t know them but we possible specific causes)

Complications of hypertension

A. Central nervous system:

Stroke: is common complication of hypertension and may be due to cerebral hemorrhage or infarction. (is abnormal function of neural due to hemorrhage or embolism).

Hypertensive encephalopathy: it is rare condition characterized by high blood pressure and neurological symptoms including transient disturbance of speech and vision, paraesthesiae, disorientation.

B. Heart:

1-left ventricular hypertrophy (the mass of myocardium so more blood

2-atrial fibrillation

3-Ischemic heart disease (Angina and infarction)

4- left ventricular failure and pulmonary edema.

And then heart failure most common due to pulmonary edema.
C. Kidney: renal disease may result be result of hypertensive damage to renal vessels. Long standing hypertension may cause protein-uria, and progressive renal failure.

D. Retina: hypertensive retino-pathy: long standing hypertension results in compensatory thickening of arterial wall, which effectively reduces capillary perfusion pressure. With sudden increase of blood pressure hemorrhage is likely to occur.

**Note:** All other organ can be affected but this is the most common complication.

E. Malignant or accelerating hypertension in young age: This rare complicate hypertension of any etiology and is characterized by accelerated micro-vascular damage with necrosis in the wall of small arteries and arterioles (fibrinoid necrosis) and intra-vascular thromosis. The diagnosis is based on evidence of high blood pressure and rapidly progressive end-organ damage such as retinopathy, renal failure and/or hypertensive encephalo-pathy. Left ventricular failure may occur, and if this is untreated, death occurs within months. (This called malignant because if the patient have it we lose him after 3-4 years)

**Prevention**

- **Weight reduction** and regular aerobic exercise (e.g., walking):
- Reducing dietary sugar.
- Reducing sodium (salt) in the body.
- Additional dietary changes beneficial to reducing blood pressure include the DASH diet (dietary approaches to stop hypertension)
- Discontinuing tobacco use
- Limiting alcohol intake
- Reducing stress, for example with relaxation therapy.
Treatment

Lifestyle modifications

- Lose weight if overweight
- Limit alcohol
- Increase physical activity
- Decrease sodium intake
- Keep potassium intake at adequate levels
- Take in adequate amounts of calcium and magnesium
- Decrease intake of saturated fat and cholesterol
- Stop smoking

Orthostatic (or postural) hypotension (a fall in blood pressure of ≥ 20/10 mmHg from lying to standing position):

1. It is an abnormal drop in blood pressure on assumption of standing position. It is caused by:

   1. Reduced blood or fluid volume: as in excessive use of diuretics, loss of GIT fluid (diarrhea and vomiting), and loss of fluid in prolong bed rest.

   2. Drugs induce hypotension: anti-hypertensive drugs and psychotropic drugs.

   3. Aging: weakness and dizziness on standing are common complaints of elderly persons. Postprandial (after meal) blood pressure often decreases in elderly persons especially after a high-carbohydrate meal

4. Bed rest and immobility: Prolonged bed rest promotes a reduction in plasma volume, a decrease in venous tone, failure of peripheral vasoconstriction, and weakness of skeletal muscles that support the veins and assist in returning blood to the heart.

5. Disorder of autonomic nervous system function: