Important notes in hypertension:

- Asymptomatic unless in late stages

Definition of hypertension:

- Diastolic blood pressure is more 90
- Systolic blood pressure more than 140
- Meaning more than 140/90

Risk factors are not important, however:

- The most important risk factors are: (Genetic, race, gender)
- Why post menopause? Because estrogen production is gone.

Classification of hypertension:

Depends on:

1- **Clinical findings.**

- Most common is benign hypertension
- 5% malignant hypertension:
  - When the diastolic is more than 120
  - Doesn't mean cancer, it only tells us it's very progressive.
  - Why is it important?
    Because it can affect these organs:
    - Kidney – acute renal failure
    - Retina
    - Brain – hemorrhage
    - Heart
- Hypertension is a risk factor of atherosclerosis

2- **Cause of hypertension:**

- **Primary – essential – unknown etiology:**

  What's its mechanism? (Pathogenesis)

  - Defect in sodium excretion leading to reabsorption of fluid leading to increase in blood volume (only one we're sure of)
- **Secondary hypertension: we know the reason (10%):**
  - Renal & Endocrine diseases are what causes it and the most important one is renal artery stenosis:
    - Blood to the kidney is going to be less so adrenal glands will secrete renin which will turn angiotensin I to angiotensin II (vasoconstriction)
    - Small kidney + hypertension = renal artery stenosis
      - How can we see the small kidney? Ultrasound
  - Polycystic kidney disease is an inherited disease causing SH

Regulation of blood pressure:

1- Cardiac output – blood volume – heart rate:
   - Blood volume is high with increased sodium intake
   - Cardiac factors- increased heart rate will increase blood pressure but not the diastolic the systolic one will increase (like after exercise it will increase for like 5 minutes then will go back to normal)

2- Peripheral resistance in the arteries:
   - Endocrine factors:
     - Angiotensin II
     - Aldosterone
   - Neural factors
     - Sympathetic
     - Parasympathetic

Morphology:

- Large blood vessels (macroangiopathy).
- Small blood vessels (microangiopathy):
  - Arteriolosclerosis
    - Hyaline arteriolosclerosis:
      - Only collagen, no specific structure
      - Occurs in essential hypertension
      - Later on it causes benign nephrosclerosis (narrow lumen – arterioles inside the kidney itself
    - Hyperplastic arteriolosclerosis:
      - Malignant hypertension
      - Onion skin appearance
      - Fibrinoid necrosis

What can we find in the heart?

Left ventricular hypertrophy (most imp) and the reason for that is that the blood coming to the heart is little from the lungs so its sustained in the lungs and the patient comes with dyspnea and pulmonary edema because the blood in the lungs can't go to the heart.

Complications:

These are complications of patients who weren't treated or who were badly treated.
As we said it affects 4 organs but can cause atherosclerosis in any part of the body

1- **Heart.**
   - Left ventricular hypertrophy. (Not everyone)
   - Coronary heart disease
   - Aortic dissection (aneurysm because of atherosclerosis then dissecting aneurism meaning blood enters the wall itself)

2- **Kidney:**
   - Benign (essential) nephrosclerosis.
   - Renal failure in untreated or malignant hypertension:
     Glomeruli: if we have malignant hypertension all these vessels or capillaries show hyperplastic, arteriosclerosis, and fibrinoid necrosis. Which later will lead to renal failure.

3- **Eyes:**
   Hypertensive retinopathy

4- **Brain:**
   - Atherosclerosis and thrombus formation
   - Hemorrhage (because of increased blood pressure)

Note:

Renal artery stenosis is not a complication of hypertension it is one of the causes of secondary hypertension and its congenital.

Atrial natriuretic peptide: (Dr. Sufia):

- It is a protein (polypeptide) hormone secreted by the heart muscle cells in the atria of heart (atrial myocytes).
- Function of the aldosterone:
  Acts mainly in the functional unit of the kidneys to aid in:

- The conservation of sodium
- Secretion of potassium
- Water retention
- Stabilize blood pressure.

Endocrine factors: (Dr. Sufia)

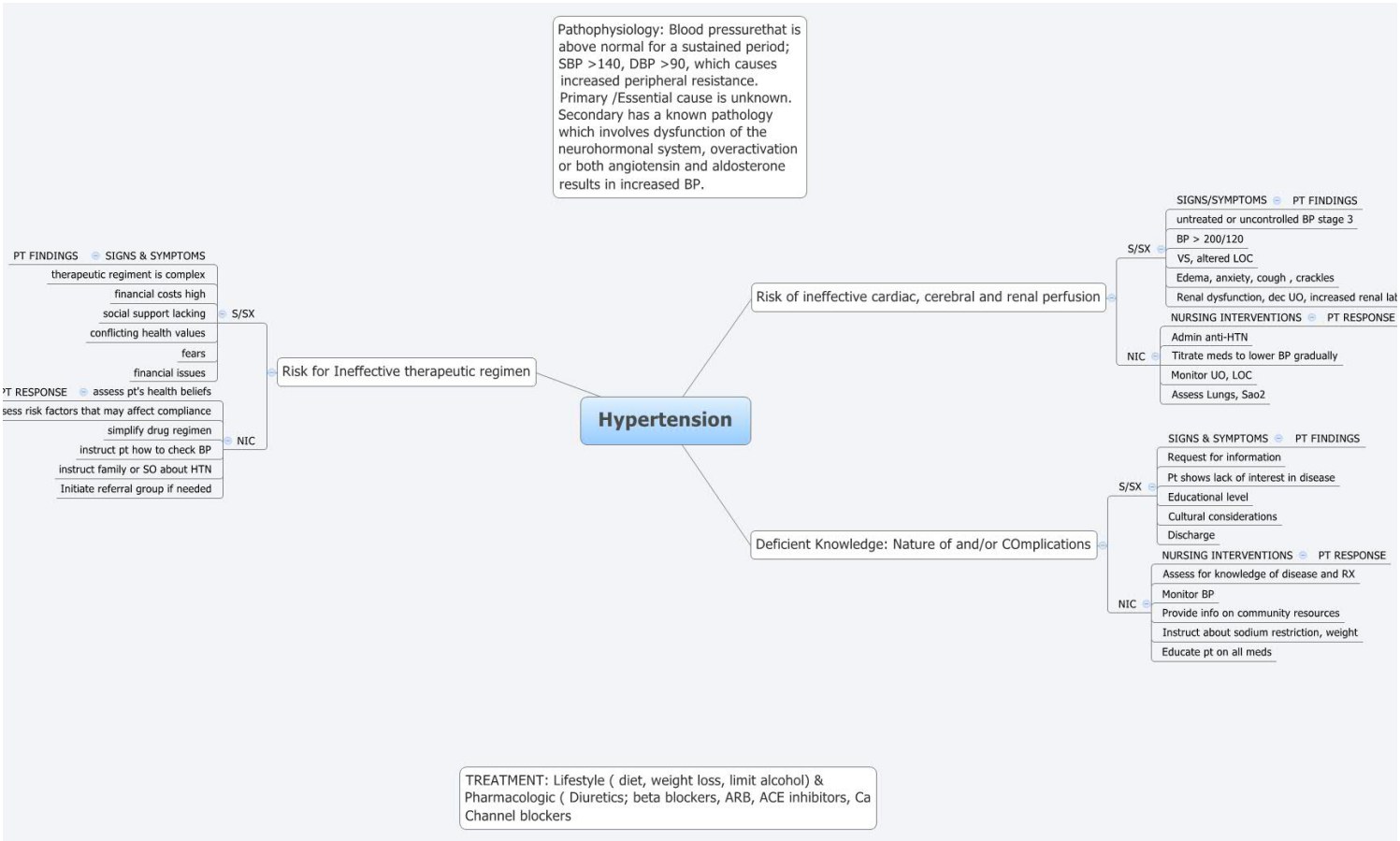
- The Renin angiotensin is produced by the kidney & the angiotensinogen by the liver.
- The kidney and liver release these substances when the blood pressure is dropping.
- The renin will activate the angiotensinogen to angiotensin I, then the angiotensin one will be convert by an enzyme called (angiotensin-converting-enzyme) to angiotensin II (this one is very powerful)
  1- It will reduce the hypothalamus to make you feel thirsty. Then, we will drink water that means we're increasing our water volume in the body.
  2- It will cause vasoconstriction > lead to increase peripheral resistance > increase BP.
  3- It will go to adrenal cortex and produce aldosterone > which causes Na and water retention
- All of these things lead to high BP.

Summary:

- Systemic hypertension is one of the most prevalent and serious causes of coronary artery and myocardial disease.
- It is defined as a persistent increase in systemic blood pressure to levels above 140 mm Hg systolic or 90 mm Hg diastolic, or both.
- Chronic hypertension causes compensatory hypertrophy of the left ventricle as a result of the increased workload imposed on the heart muscle. The left ventricular wall and interventricular septum become uniformly thickened.
- Congestive heart failure is the most common cause of death in untreated hypertensive patients.
- Intracerebral hemorrhage is also a frequent fatal complication.
- In addition, death may result from coronary atherosclerosis and myocardial infarction, dissecting aneurysm of the aorta, or ruptured berry aneurysm of the cerebral circulation.
- Renal failure may supervene when nephrosclerosis induced by hypertension becomes severe.
- One theory behind essential hypertension is that there are defects in renal sodium homeostasis that reduce renal sodium excretion. The kidney retains sodium and water, increasing intravascular fluid volume, which drives increased cardiac output. Cardiac output is compensated by increasing peripheral vascular resistance, causing an increase in blood pressure.
- If angiotensin converting enzyme (ACE) were absent, blood pressure would decrease because angiotensin I would not be converted to angiotensin II (drugs that act as ACE inhibitors are antihypertensive).
- An elevated plasma renin level is typical of renovascular hypertension, which can occur with narrowing of a renal artery.
- Hypertensive patients with hypokalemia also can have hyperaldosteronemia, which can be caused by an aldosterone-secreting adrenal adenoma.
- Increased urinary catecholamines can indicate increased catecholamine output from a Pheochromocytoma.
- Hypertension is a common disorder affecting 25% of the population; it is a major risk factor for atherosclerosis, congestive heart failure, and renal failure.
- Essential hypertension represents 95% of cases and is a complex, multifactorial disorder, involving both environmental influences and genetic polymorphisms that may influence sodium resorption, aldosterone pathways, and the renin–angiotensin system.
- Hypertension occasionally is caused by single-gene disorders or is secondary to diseases of the kidney, adrenal, or other endocrine organs.
- Lacunar infarct:
  A type of stroke that results from occlusion of one of the penetrating arteries that provides blood to the brain's deep structures

- Cerebral infarction:
  A type of ischemic stroke resulting from a blockage in the blood vessels supplying blood to the brain.)
- Benign nephrosclerosis:
  Refers to the renal changes most commonly occurring in association with long-standing hypertension.
- Arteriolitis:
  Inflammation of arteries.
- Fibrinoid necrosis:
  Accumulation of amorphous, basic, proteinaceous material in the tissue matrix with a staining pattern reminiscent of fibrin.
- Aortic dissection:
- A serious condition in which the inner layer of the aorta the large blood vessel branching off the heart, tears.
- Retinopathy:
  Disease of the retina, which results in impairment or loss of vision.
- Hypertensive encephalopathy:
  A syndrome consisting of a sudden elevation of arterial pressure usually preceded by severe headache and followed by convulsions, coma or a variety of transitory cerebral phenomena)

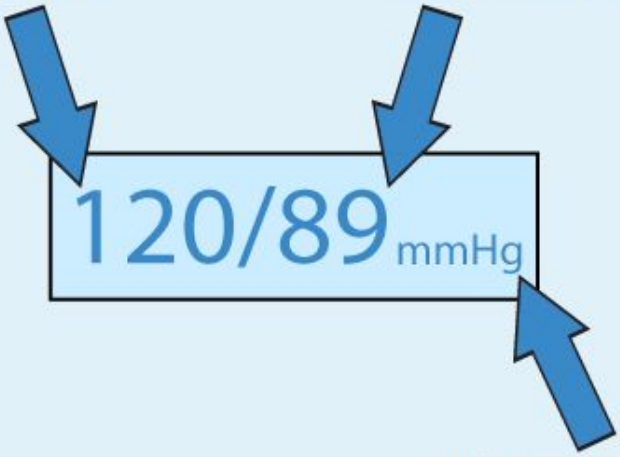
Please zoom in for better resolution:



Systolic and Diastolic Blood Pressure

Systolic blood pressure:
The pressure of blood in the vessels when the heart beats (SPB)

Diastolic blood pressure:
The pressure between beats when the heart relaxes (DBP)



millimeters of mercury

Blood Pressure Ranges

Blood Pressure Category	SBP mmHg		DBP mmHg
Hypotension	< 90	or	< 60
Normal Blood Pressure	90 - 119	or	60 - 79
Prehypertension	120 - 139	or	80 - 89
High Blood Pressure Stage 1	140 - 159	or	90 - 99
High Blood Pressure Stage 2	160 - 179	or	100 - 109
Hypertensive Crisis	180 or higher	or	110 or higher

Lifestyle Modifications to Manage High Blood Pressure

Lifestyle Modification	Recommendation	Approximate SBP Reduction
Weight loss	Maintain normal body weight (body mass index 18.5-24.9 kg/m2).	5-20 mmHg/10 kg weight loss
Adopt DASH eating plan	Consume a diet rich in fruits, vegetables, and lowfat dairy products with a reduced content of saturated and total fat.	8-14 mmHg
Dietary sodium reduction	Reduce dietary sodium intake to no more than 100 mmol per day (2.4 g sodium or 6 g sodium chloride).	2-8 mmHg
Physical activity	Engage in regular aerobic physical activity such as brisk walking (at least 30 min per day, most days of the week).	4-9 mmHg
Moderation of alcohol consumption	Limit consumption to no more than 2 drinks (1 oz or 30 mL ethanol; e.g., 24 oz beer, 10 oz wine, or 3 oz 80-proof whiskey)	2-4 mmHg

Check your understanding with MCQs:

1- Malignant hypertension is associated with all of the following, except:

A. Development of renal failure
B. Hypertensive encephalopathy
C. Left ventricular failure
D. Tachycardia

2- One of the things that affect sodium secretion is the defect in cell membrane function of transporting:

A. Na/k
B. Na/Ca
C. Na/cl
D. Na/co

3- Blood pressure that rapidly progressive with diastolic above 140 mmHG can cause cerebral edema/ loss of function, which of the following terms best describes this type of bp?

A. Prehypertension
B. Isolated hypertension
C. Malignant hypertension

4- What is a normal first symptom of high blood pressure?

A. Headache
B. Pain in arms and legs
C. No symptoms at all

5- Two hemodynamic variables are involved in the regulation of bp:

A. Cardiac output and peripheral vascular resistance
B. Cardiac output and central vascular resistance
C. Venous return and cardiac output
D. Central vascular resistance and peripheral vascular resistance

6- Risk factors for hypertension:

A. Smoking
B. C and D
C. Type e personality
D. Malnutrition

7- One of the main characteristics of hyaline arteriolosclerosis under the microscope is:

A. Concentric, laminated thickening of arteriolar wall
B. Fibrinoid necrotizing arteriolitis in the kidney
C. Nephrosclerosis
D. Thickened, reduplicated basement membrane

1: D	2: B	3: C	4:C	5:A	6: A	7: C

8- Poorly treated hypertension may lead to:

A. Atherosclerosis
B. Left sided hypertensive heart disease
C. Aortic dissection
D. Heart failure (hypertensive heart disease)

9- Which of the following is an indication oh hypertension?

A. Sustained diastolic pressure more than 90 mm Hg
B. Sustained systolic pressure less than 140 mm Hg
C. Pressure = 120/80
D. None of these are an indication of it.

10- Which of these people is at least risk of hypertension?

A. A 60 year old man with a history of smoking
B. Post-menopausal women in her 60's
C. Pre-menopausal women in her 20's
D. A 40 year old African American who's diabetic

11- Which of the following is not a feature of benign hypertension?

A. Modest level.
B. Fairly stable over years to decades.
C. Compatible with long life.
D. Leads to organ damage

12- Which of the following increases blood pressure?

A. Increased Na excretion.
B. Decreased sympathetic stimulation.
C. Decreased Na excretion

13- Onionskin appearance is a characteristic of?

A. Hyaline arteriosclerosis
B. Atherosclerosis
C. Hyperplastic arteriosclerosis
D. None of these

14- Benign nephrosclerosis is a characteristic of?

A. Hyaline arteriosclerosis
B. Atherosclerosis
C. Hyperplastic arteriosclerosis
D. None of these

15- which of these is a cause of secondary hypertension except:

A. Glomerulonephritis
B. Renal vasculitis
C. Renal disease
D. All of these

8: B	9: A	10: C	11: D	12: C	13: C	14: A	15: D

*** Questions in red are important.**

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قال صلى الله عليه وسلم: من سلك طريقًا يلتمس فيه علمًا سهّل الله له به طريقًا إلى الجنة

دعواتنَا لكم بالتوفيق.