PATHOLOGY

بسم الله الرحمن الرحيم

FINAL | Lecture 6

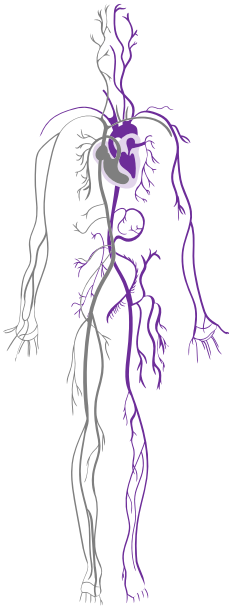
وَلَقَدْ خَلَقْنَا الْإِنسَانَ وَنَعْلَمُ مَا تُوَسْوِسُ بِهِ نَفْسُهُ ۖ وَنَحْنُ أَقْرَبُ إِلَيْهِ مِنْ حَبْلِ الْوَرِيدِ

اللهم إنّا نعوذ بك من شرور أنفسنا ومن سيئات أعمالنا

Hypertensive Vascular Disease

Written by: Aya Ghalayini

Reviewed by: Deema Nasrallah



وَلِلَّهِ الْأَسْمَاءُ الْحُسْنَى فَادْعُوهُ بِهَا

المعنى: الباقي بعد فناء الخلق والمسترد أملاكهم ومواريثهم بعد موتهم، ولم يزل الله باقيًا مالكًا للأشياء كلها يورثها من يشاء، ويستخلف فيها من أحب.

الورود: ورد في القرآن (٣) مرات.

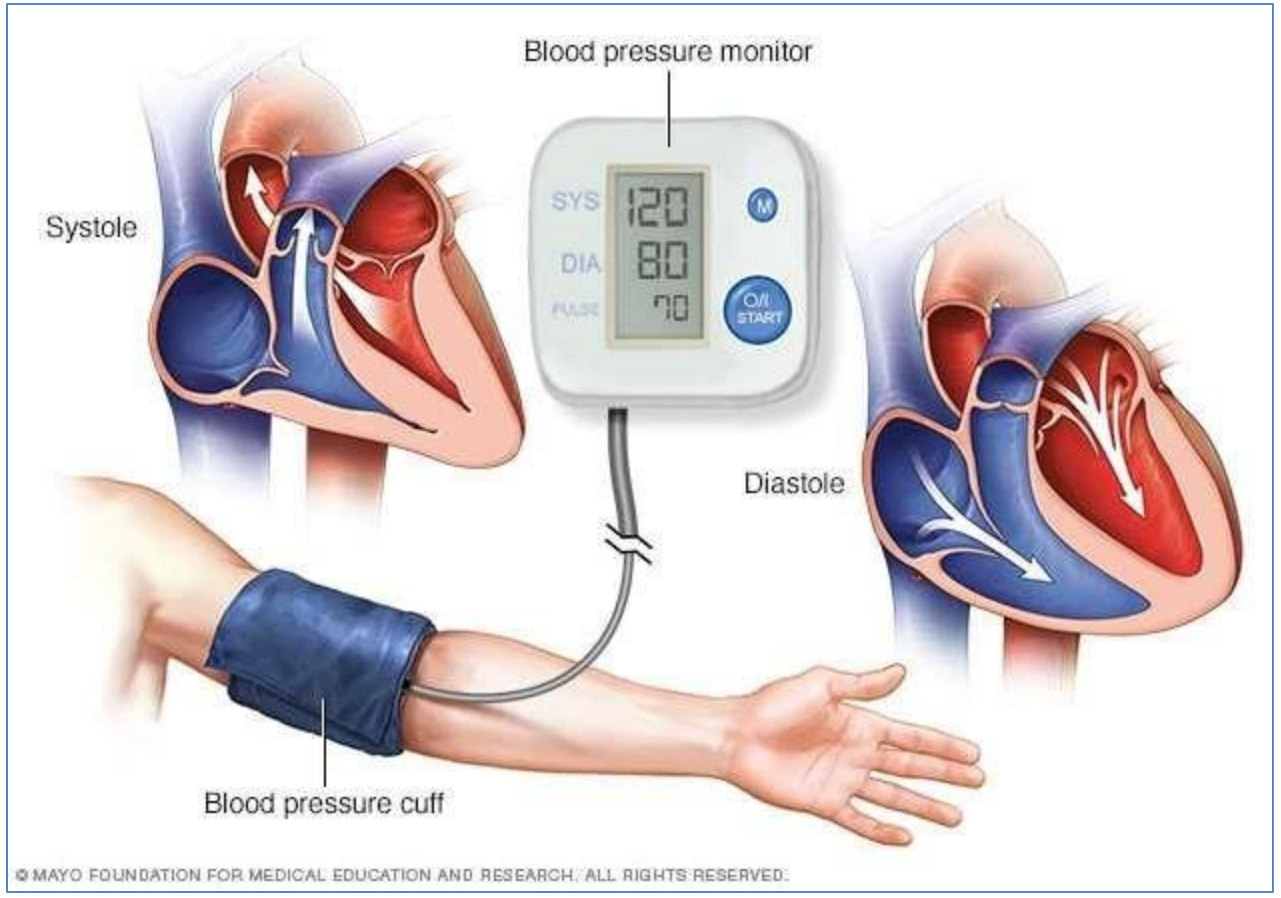
الشاهد: ﴿ وَإِنَّا لَنَحْنُ نُحْيِۦ وَنُمِيتُ وَنَحْنُ ٱلْوَٰرِثُونَ ﴾ [الحجر:٢٣].

اضغط هنا لشرحٍ أكثر تفصيلًا

HYPERTENSIVE VASCULAR DISEASE

Arteriolosclerosis

Dr. Nisreen Abu Shahin
Professor of Pathology
Pathology Department
University of Jordan



A sphygmomanometer or a Digital blood pressure monitor is used to measure BP, and both provide two key values: systolic and diastolic pressures

Blood pressure

- Currently, cutoffs in diagnosing hypertension in clinical practice: sustained diastolic pressures >80 mm Hg, and/or sustained systolic pressures >130 mm Hg

Types of hypertension

Hypertension can be classified in several ways:

- **According to severity:**

Benign (95%) versus malignant (5%)

- **According to cause(etiology):**

Primary (essential) (95%) versus secondary (5%)

Depending on whether a clear underlying cause can be identified.

Primary hypertension has no significant identifiable cause, unlike secondary hypertension which has identifiable underlying factor.

- **Another way to classify:** systolic or diastolic

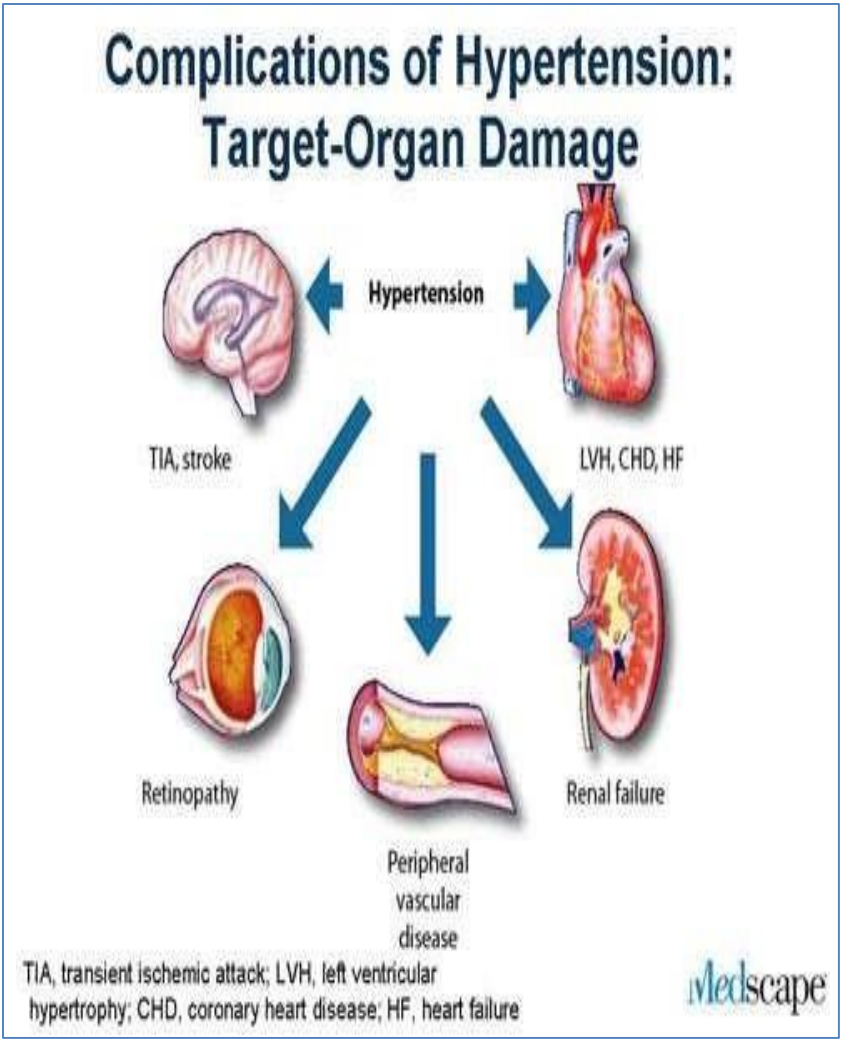
hypertension.

By deciding the side of circulation that is affected by high blood pressure readings.

Malignant hypertension

- 5% (also known as accelerated HTN).
  - 5% of hypertensive patients may experience **attacks** of markedly elevated blood pressure, with **systolic** values exceeding **200 mmHg** and **diastolic** values rising above **120 mmHg**. This severe state is known as **malignant hypertension**, also referred to as **accelerated hypertension**.
  - Despite the name "malignant", it is not related to malignancy; the term reflects its extremely poor prognosis if untreated.
- a rapidly rising blood pressure that, if untreated, leads to **death within 1 to 2 years.**
- **systolic pressures > 200 mm Hg or diastolic pressures > 120 mm Hg.**
- It also can lead to end-organ damage, consequently renal failure and retinal hemorrhages, plus other end-organ damage.
- usually superimposed on preexisting benign hypertension (either essential or secondary). In many cases, it is related to uncontrolled hypertension whether primary/secondary.

Hypertension (HTN) has the following potential complications:



Uncontrolled hypertension of any underlying etiology can lead to a wide range of complications collectively referred to as target-organ damage:

- stroke (CVD) &multi- infarct dementia
- atherosclerotic coronary heart disease

Hypertension can contribute to the development and accelerate atherosclerosis within the coronary arteries.

- cardiac hypertrophy and heart failure (*hypertensive heart disease*)

Chronic pressure overload induces left ventricular hypertrophy, which may eventually progress to heart failure, producing what is termed hypertensive heart disease.

- aortic dissection

Hypertension can additionally weaken the aortic wall, predisposing to aortic dissection.

- renal failure
- retinal hemorrhages

Types of hypertension- according to etiology

1 essential (idiopathic) hypertension (95%)

2 secondary hypertension:

- **Most common of secondary**: renal disease or renal artery narrowing **(renovascular hypertension)**
- **Other less common: many other conditions….**

Essential Hypertension

Accounts for 90% to 95% of all cases

Most common of all

Secondary Hypertension

Most common of secondary causes

Renal

Acute glomerulonephritis
Chronic renal disease
Polycystic disease
Renal artery stenosis
Renal vasculitis
Renin-producing tumors

Endocrine

Adrenocortical hyperfunction (Cushing syndrome, primary aldosteronism, congenital adrenal hyperplasia, licorice ingestion)
Exogenous hormones (glucocorticoids, estrogen [including pregnancy-induced and oral contraceptives], sympathomimetics and tyramine-containing foods, monoamine oxidase inhibitors)
Pheochromocytoma
Acromegaly
Hypothyroidism (myxedema)
Hyperthyroidism (thyrotoxicosis)
Pregnancy-induced (pre-eclampsia)

Cardiovascular

Coarctation of aorta
Polyarteritis nodosa
Increased intravascular volume
Increased cardiac output
Rigidity of the aorta

Neurologic

Psychogenic
Increased intracranial pressure
Sleep apnea
Acute stress, including surgery

The doctor only mentioned the name of each category (red boxes)

Pathogenesis of essential HTN

The pathogenesis of essential hypertension is multifactorial and involves both genetic factors and environmental influences.

Genetic factors

Genetic factors that are related to essential hypertension **might** be related to:

- **familial clustering of hypertension**
- Gene polymorphism: angiotensinogen **polymorphisms** and angiotensin II receptor variants; polymorphisms of the renin-angiotensin system.
- **Susceptibility** genes for essential hypertension: genes that control renal sodium absorption, etc…
- **Environmental factors** modify the impact of genetic determinants

stress, obesity, smoking, physical inactivity, ↑ salt consumption

Blood vessels in HTN- Morphology

- **HTN is associated with arteriolosclerosis (small arterial disease).**

The most affected vessels in hypertension are small arteries, particularly arterioles, leading to arteriolosclerosis.

- **Two forms of small blood vessel disease are hypertension-related:**

1 **hyaline arteriolosclerosis**

2 **hyperplastic arteriolosclerosis**

1-Hyaline Arteriolosclerosis

- hyaline arteriolosclerosis, is associated with benign hypertension.
- It is called “hyaline” because of the pinkish, homogeneous material that causes the thickening of the arteriole wall. This thickening eventually leads to luminal narrowing, which has important consequences for the tissues supplied by these arterioles.
- The luminal narrowing and the pinkish material within the arteriole wall result from leakage of plasma proteins across injured endothelial cells.
- Hypertension causes **micro-trauma** to the endothelium, and this injury allows plasma proteins to leak into the arteriole wall.
- This process also triggers an inflammatory response, and the smooth muscle cells lining the media produce extracellular matrix proteins, further contributing to wall thickening.
- These changes represent the vessel’s response to the chronic hemodynamic stress imposed by hypertension.

1- Hyaline arteriolosclerosis

- Ass. with benign hypertension
- homogeneous pink hyaline thickening of arteriolar walls
- luminal narrowing
- leakage of plasma components across injured endothelial cells into vessel walls
- increased ECM production by smooth muscle cells in response to chronic hemodynamic stress

Hyaline arteriolosclerosis: Complications

Remember: Hyaline arteriosclerosis can affect any organ

Most significant in kidneys→ nephrosclerosis (glomerular scarring).

In kidneys, chronic damage to the arterioles eventually leads to **nephrosclerosis** (or **glomerular scarring**), and over time, this can progress to chronic renal failure.

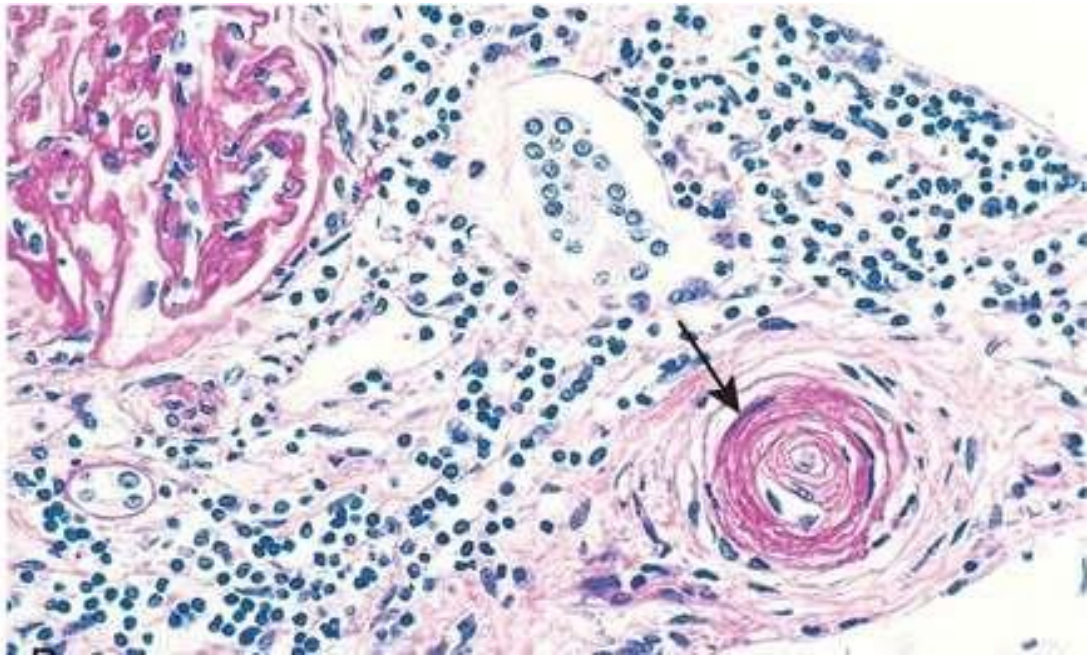
Other causes of hyaline arteriolosclerosis(without the presence of hypertension):

1. **elderly patients (normo-tensive),** as a part of the aging process.
2. **diabetes mellitus**

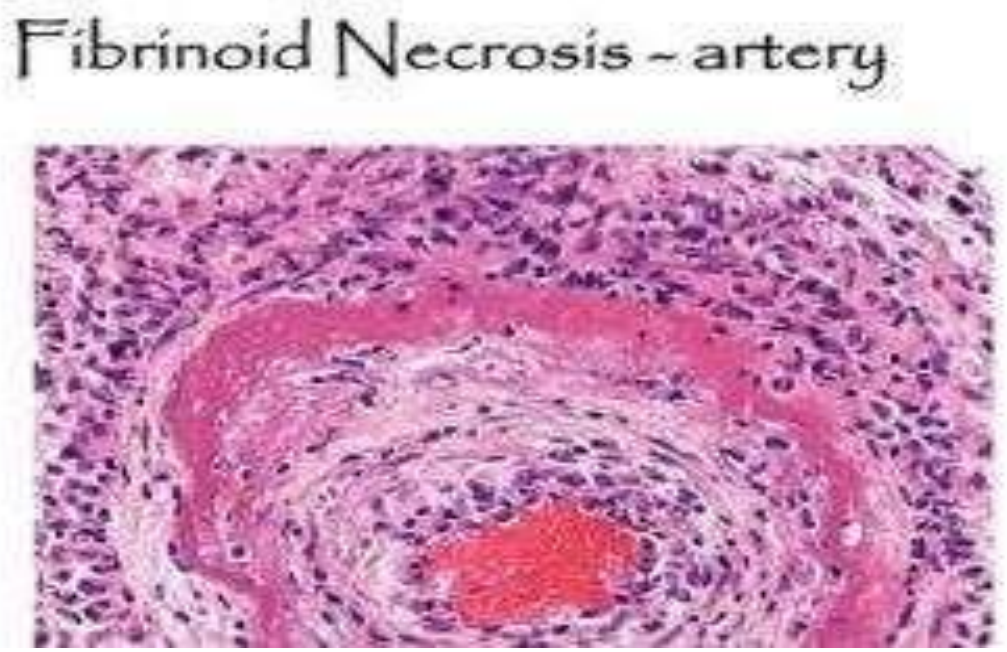
2- Hyperplastic arteriolosclerosis

- With **severe (malignant) hypertension.**
- "**onionskin**" concentric laminated thickening of arteriolar walls
- luminal narrowing
- reduplicated basement membrane
- fibrinoid vessel wall necrosis
  (necrotizing arteriolitis)

- The hallmark of this condition, seen under the microscope, is the onion skin appearance of the arterioles. This appearance results from concentric laminated thickening of the arteriole wall, which leads to luminal narrowing and can even cause complete occlusion. These changes develop following recurrent attacks of very high blood pressure.
- Another abnormality that can be observed in malignant hypertension is fibrinoid visceral wall necrosis, also called necrotizing arteriolitis.



Onion skin appearance



Necrotizing arteriolitis

Q: What does (reduplicated basement membrane) mean ?

A: It means that the basement membrane will have multiple layers instead of the normal one, so it becomes thicker than normal and is functionally considered abnormal and results in reduced blood flow to the tissue.

The presence of these multiple layers will give the appearance of the onion when it is cut. This is termed (onion skin) appearance.

Physiology Quiz 6

PATHOLOGY QUIZ

LECTURE 6

Scan the QR code or click it for FEEDBACK

Corrections from previous versions:

Versions	Slide # and Place of Error	Before Correction	After Correction
V0 → V1			
V1 → V2			