INTRO TO PATHOLOGY REVIEW SESSION

October 10th 2024

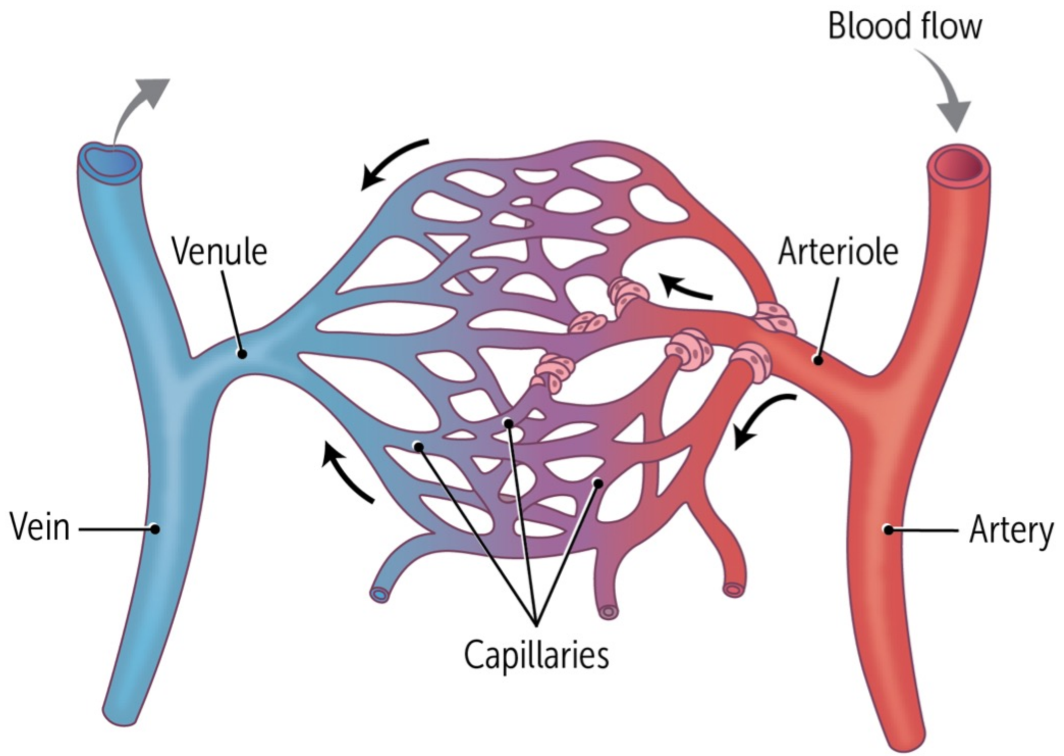
CARDIOVASCULAR PHYSIOLOGY

BLOOD PRESSURE

- What is normal blood pressure ?
  - 120/80
- What occurs when Blood pressure is too low ?
  - Organs are not perfused with blood – can become dizzy and pass out, can lead to kidney failure and eventually shock and cell death
- What occurs when blood pressure is too high ?
  - Increased risk for heart attack, stroke , and kidney failure due to alterations of the blood vessels

CARDIOVASCULAR SYSTEM

- What are arteries ?
  - Blood vessels that act as conduits to transport blood from the heart to organs and tissues.
- What are Arterioles ?
  - Resistance vessels to regulate blood pressure and adjust blood distribution among tissues
- What are Capillaries ?
  - Branching blood vessels that connects veins and arteries for Oxygen/Co2 and metabolite exchange
- What are veins ?
  - Blood vessels that act as conduits and reservoirs for blood towards the heart



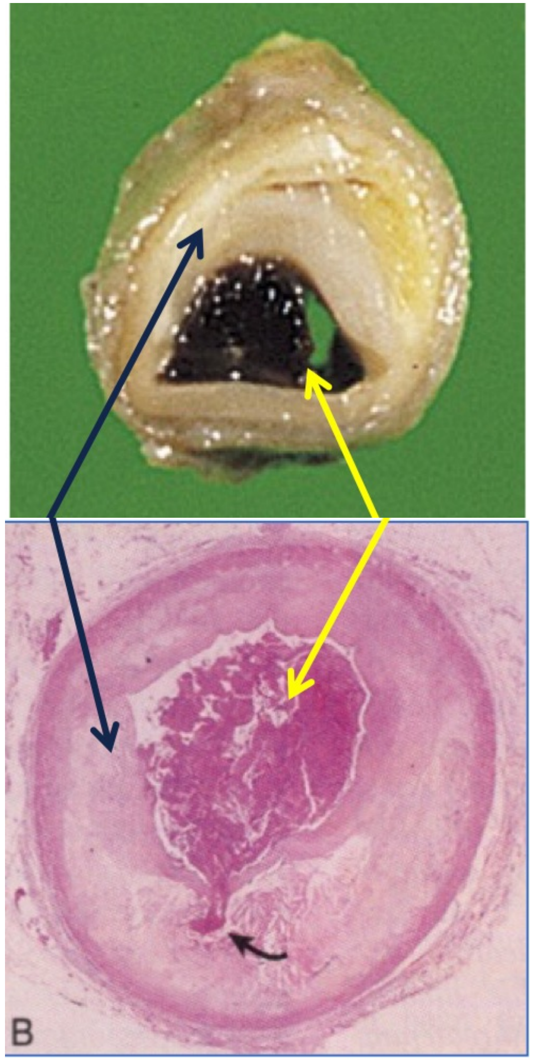
WHAT ARE THE COMPLICATIONS OF HYPERTENSION (HTN)?

- Hint : The 5 C’s
- Coronary artery disease
- Chronic renal failure
- Congestive heart failure
- Cardiac arrest
- Cerebrovascular accident

PATHOLOGY OF HYPERTENSION

Blue Arrow :

Atherosclerosis



Yellow Arrow :

Thrombus

TYPES OF HYPERTENSION ?

- What are the types of hypertension ?
  - Answer : Primary and secondary
- True or false : The cause of primary hypertension is due to a complication of another medical problem such as the kidneys or liver.
  - Answer : False. This is the definition of secondary hypertension. The cause of primary hypertension is unknown

HEMOSTASIS

WHAT ARE THE THREE STEPS TO HEMOSTASIS?

1. Blood Vessel Constriction
2. Platelet Plug Formation (Primary hemostasis)
3. Fibrin Mesh Formation (Secondary hemostasis) – Fibrin Formation (Coagulation Cascade)

WHAT IS THIS MEDICAL TERM ?

- Definition : Platelets and crosslinked fibrin with entrapped red and white blood cells
- Hint : Known as a “Blood Clot”
- Answer : Thrombus

NAME DIFFERENT TYPES OF BLEEDING DISORDERS

- Hemophilia – Deficient coagulation factors
- Von Willebrand Disease
- Disseminated Intravascular Coagulation
- Idiopathic Thrombocytopenic Purpura
- Thrombotic Microangiopathies
- Hereditary Platelet Disorders

HEMOPHILIA

- What are the 2 main types of Hemophilia ?
  - Answer : Type A and Type B
- What are the mutations of Hemophilia A?
  - Mutations in the factor VIII gene
- What are the mutations of Hemophilia B?
  - Factor IX gene
- Is this an inherited defect ?
  - Answer : Majority of cases are inherited there are some cases of spontaneous mutations in Factor VIII

WHAT ARE THE SYMPTOMS OF BLEEDING DISORDERS ?

- Nosebleeds
- Bleeding gums
- Swollen and stiff joints
- Bruises
- Coughing or vomiting blood
- Blood in stool or urine
- Heavy menstrual bleeding

THROMBOEMBOLISM

- What is an Embolism ?
  - Answer: An obstruction of an artery
- What is a thromboembolism ?
  - Answer: A thrombus or piece piece that breaks off and forms an embolus and causes an embolism . This can be arterial or venous

HOW DO YOU TREAT THROMBOTIC DISORDERS ?

- Anticoagulants – Block the coagulation
- Antiplatelet agents – Block platelet function
- Fibrinolytic agents- Dissolve the thrombus
- What happens with overtreatment ?
  - Bleeding – Hemorrhage stroke

HEART DISEASE AND REGENERATION

BLOOD EXCHANGE

- What is the difference between oxygenated blood and deoxygenated blood ?
  - Oxygenated blood is pumped out of the heart through the arteries to the body/organ.
  - How is oxygenated blood delivered to the body ?
    - **Answer:** The capillaries in exchange for deoxygenated blood
  - Deoxygenated blood travels through the veins and returns to the heart to be reoxygenated in the lungs

SYMPTOMS OF CVD

- What is a myocardial Infarction ?
  - Blockage of blood flow to the heart
- What is a Cardiac Arrest?
  - Electrical malfunction leading to the loss of blood flow
- What is a Congestive heart failure ?
  - Heart is unable to pump blood and meet body’s demand

KIDNEY DISEASE

SYMPTOMS OF KIDNEY DISEASE

Early

- Loss of appetite
- Altered taste sensation
- Lack of energy
- Poor concentration
- Pruritus
- Swelling in legs ankles feet face or hands

Late

- Coma
- Intractable vomiting
- Paresthesias (weakness)
- Shortness of breath
- Passing less urine

WHAT ARE THE RISK FACTORS FOR CHRONIC KIDNEY DISEASE ?

- Modifiable risk Factors ?
  - Diabetes
  - Hypertension
  - History of AKI
  - Frequent NSAID use

- Non Modifiable Risk Factors ?
  - Family history of kidney disease, diabetes or hypertension
  - Age 60 or older
  - Race/U.S. ethnic minority status

KIDNEY DISEASE AS A HEALTH DISPARITY

- African Americans are ___ times more likely to develop kidney failure than Caucasians
  - 4 times
- What are some Socio-Cultural factors that contribute to End-stage kidney disease
  - Structural Racism
  - Socio-economic factors
  - Biological Genetic Determinants
  - Environment

BLOOD TRANSFUSION

WHAT IS BLOOD MADE OUT OF ?

- Red blood cells
- White blood cells
- Plasma
- Platelets
- What is the role of Red blood cells ?
  - Carry oxygen to organs
- What is the role of white blood cells ?
  - Inflammation and fight infections

CRITERIA FOR BLOOD DONATION

- Physical Examination
- Cannot be anemic (decreased RBC)
- Weight at least 110 lbs
- Healthy blood pressure
- Inspection of arms for infection other signs of intravenous drug use

BLOOD TYPING REVIEW : ABO COMPATIBILITY

ABO TYPE	Antigens on RBCs	Antibodies in PLASMA	CAN DONATE RBCs TO TYPE(s)	CAN RECEIVE RBCs FROM TYPE(s)
O	None	Anti-A & Anti-B	All blood types	O
A	A	Anti-B	A, AB	A, O
B	B	Anti-A	B, AB	B, O
AB	AB	None	AB	All blood types

ANEMIA AND SICKLE CELL

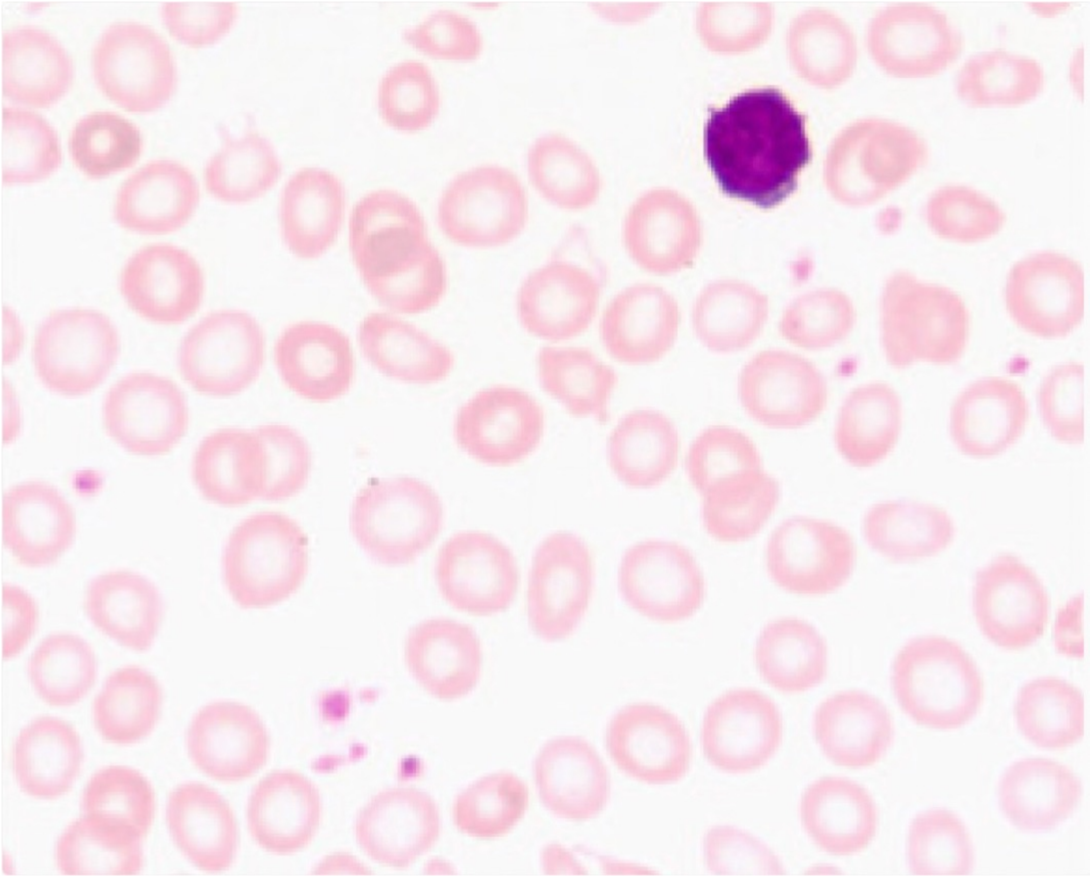
ANEMIA

- What is Anemia ?
  - Decreased red blood cell mass – decreased hemoglobin decreased ability to carry oxygen throughout the body
- What are the signs of Anemia?
  - Shortness of breath Rapid Heart rate
  - Fatigue Conjunctival pallor
  - Dizziness

TYPES OF ANEMIA

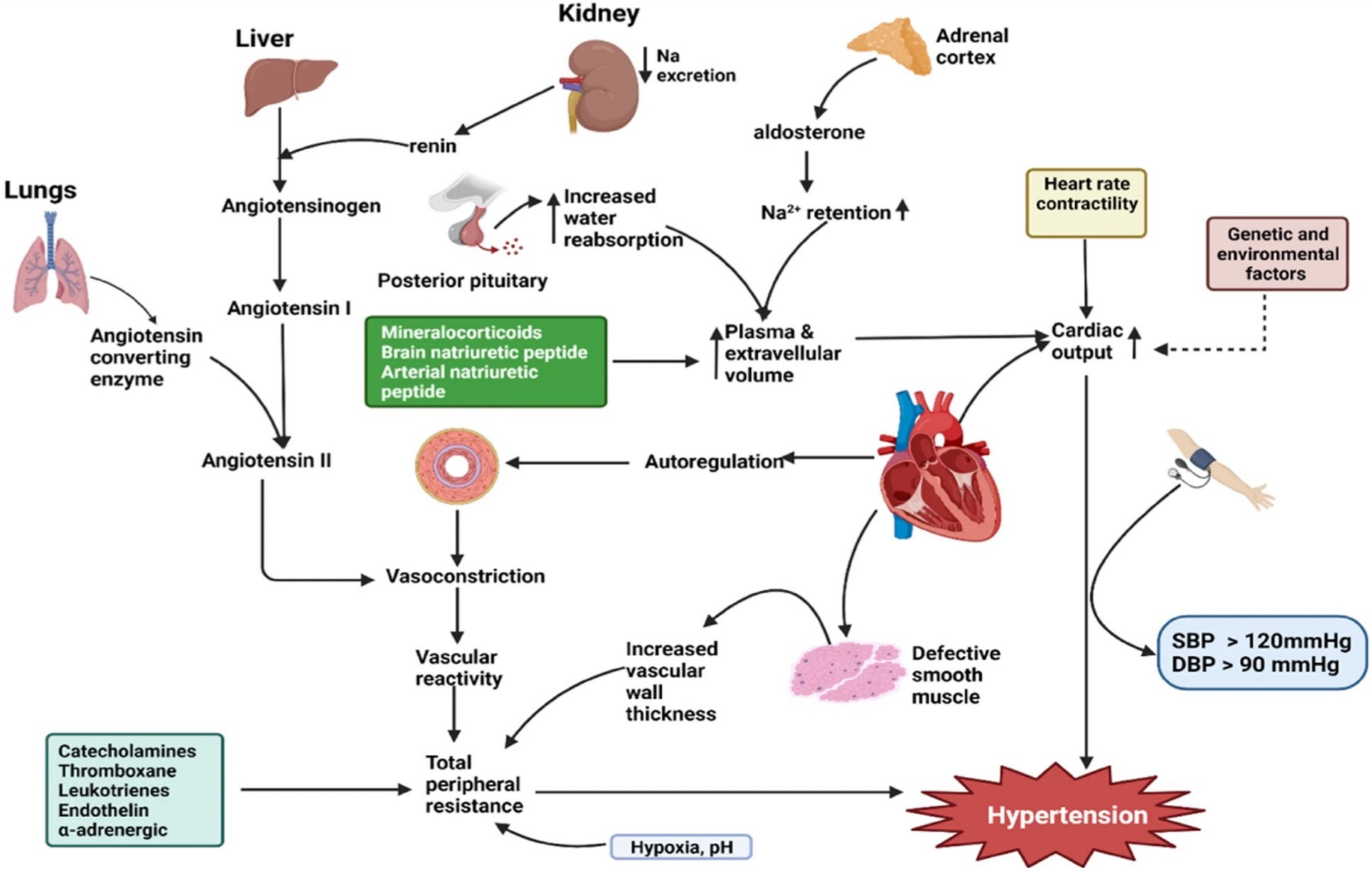
- Caused by blood loss :
  - Anemia of blood loss
- Caused by Decreased Production :
  - Iron –deficiency
  - Anemia of chronic disease
  - Megaloblastic anemia
  - Aplastic anemia
  - Sideroblastic anemia
- What is Sickle cell anemia caused by:
  - Increased Destruction

CASE STUDY



- A 23 Year old woman has been very fatigued and experiencing dizzy spells and headaches. She goes to the doctor and they look at her blood cells and you see this image.
- What type of anemia is this ?
  - Iron Deficient Anemia
- How do you know this ?
  - RBCs are small or “microcytic” , RBCs contain less hemoglobin “hypochromic”

QUESTIONS?



Kidney
Liver
Na excretion
Adrenal cortex
renin
aldosterone
Lungs
Angiotensinogen
Increased water reabsorption
Na2+ retention
Heart rate contractility
Genetic and environmental factors
Posterior pituitary
Angiotensin I
Angiotensin converting enzyme
Mineralocorticoids
Brain natriuretic peptide
Arterial natriuretic peptide
Plasma & extravellular volume
Cardiac output
Angiotensin II
Autoregulation
Vasoconstriction
Increased vascular wall thickness
Defective smooth muscle
Vascular reactivity
SBP > 120mmHg
DBP > 90 mmHg
Catecholamines
Thromboxane
Leukotrienes
Endothelin
α-adrenergic
Total peripheral resistance
Hypertension
Hypoxia, pH

BLOOD PRODUCTS

WHOLE BLOOD

RBCs

WBCs

platelets

plasma

PACKED RED BLOOD CELLS (PRBCs)

RBCs
(separated from
platelets & plasma)

PLATELET TRANSFUSIONS

FRESH FROZEN PLASMA

albumin

cryoprecipitate

STEM CELL TRANSPLANTATION