Lab Activity 25

Blood Vessels & Circulation
Artery and Vein Histology

- Walls have 3 layers:
  - Tunica intima
  - Tunica media
  - Tunica externa
Tunica Intima

- Is the innermost layer near the lumen
- Includes:
  - The endothelial lining
  - Connective tissue layer
- **Internal Elastic Membrane:** In arteries, is a thick layer of elastic fibers in the outer margin of the tunica intima
Tunica Media

- Is the middle layer
- Contains concentric sheets of smooth muscle in loose connective tissue
- Binds to inner and outer layers
Tunica Externa
(aka: Tunica Adventitia)

- Is outer layer
- Contains connective tissue sheath
- Anchors vessel to adjacent tissues
- In arteries:
  - Contain collagen
  - Elastic fibers
- In veins:
  - Contain elastic fibers
  - Smooth muscle cells
Arteries Vs. Veins

- Arteries and veins run side-by-side
- Arteries have thicker walls and higher blood pressure
- Collapsed artery has small, round lumen
- Vein has a large, flat lumen
Arteries

• Carry blood away from the heart.

• **Pulmonary arteries**: The pulmonary trunk and its branches; leave the right ventricle of the heart and contain deoxygenated blood.

• **Systemic arteries**: The aorta and its branches; leave the left ventricle of the heart and contain oxygenated blood.
Elastic Arteries

- Also called conducting arteries, these are the largest arteries
- Tunica media has many elastic fibers and few muscle cells
- Elasticity evens out pulse force
- Examples:
  - Pulmonary trunk
  - Aorta
  - Common carotid arteries
  - Subclavian arteries
  - Common iliac arteries
Aorta

el = elastic fibers
end = endothelial cells
n = smooth muscle cell
TA = tunica adventitia
TM = tunica media
TI = tunica intima
Muscular Arteries

- Also called **distribution arteries**, are medium-sized (most arteries)
- Tunica media has many muscle cells
  - **Examples**:
    - External carotid arteries
    - Brachial arteries
    - Femoral arteries
Muscular Arteries
Arterioles

- The smallest branches of arteries
- Feed into capillaries
- Have little or no tunica externa
- Have thin or incomplete tunica media
Arteriole

end = endothelial cell nucleus
n = smooth muscle nucleus
rbc = red blood cells
Capillaries

• The smallest vessels
• Structure: Simple squamous epithelium tube
  • Lumen side has a thin basal lamina
  • No tunica media, No tunica externa
• Location of exchange between blood and interstitial fluid.
  • Gasses and chemicals diffuse across their walls
• Types:
  • Continuous
  • Fenestrated
  • Sinusoids
Continuous Capillaries

• Have complete endothelial lining (most common type of capillary)

• Permit diffusion of:
  • Water
  • Small solutes
  • Lipid-soluble materials

• Prevent diffusion of:
  • Blood cells
  • Plasma proteins
Continuous Capillary

- Pericyte
- Red blood cell in lumen
- Intercellular cleft
- Endothelial cell
- Pinocytotic vesicles
- Basement membrane
- Tight junction
- Endothelial nucleus
Continuous Capillaries

Simple squamous epithelium

RBC

Basal lamina
Fenestrated Capillaries

- Have pores in endothelial lining
- Permit rapid exchange of water and larger solutes between plasma and interstitial fluid
- Are found in:
  - Choroid plexus
  - Endocrine organs
  - Kidneys
  - Intestinal tract
Fenestrated Capillary

- Pericyte
- Pinocytotic vesicles
- Red blood cell in lumen
- Fenestrations (pores)
- Intercellular cleft
- Endothelial cell
- Endothelial nucleus
- Basement membrane
- Tight junction
Fenestrated Capillary
Sinusoids

- Modified, extremely leaky, fenestrated capillaries
- Found in locales where large stuff needs to exit/enter the bloodstream.
  - Liver
  - Spleen
  - Bone marrow
  - Endocrine organs
Sinusoid

- Pericyte
- Endothelial cell
- Red blood cell in lumen
- Large intercellular cleft
- Tight junction
- Incomplete basement membrane
- Nucleus of endothelial cell

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Hepatic Sinusoid
Veins

- Carry blood to the heart
  - Are larger in diameter than arteries
  - Have thinner walls
  - Contain valves
    - Folds of tunica intima that prevent blood from flowing backward

- Venules: The smallest veins that carry blood away from the capillaries
Veins

- **Medium-sized veins:**
  - Thin tunica media and few smooth muscle cells
  - Tunica externa with longitudinal bundles of elastic fibers
- **Large veins:**
  - Have all 3 tunica layers
  - Thick tunica externa
  - Thin tunica media
    - Example: Inferior and Superior vena cava
Venous Valve in Medium Vein

ad = adipose tissue
TA = tunica adventitia
TM = tunica media
v = valve
Large Vein

Slide 67 Jugular vein

- Tunica intima
- Tunica media
- Tunica adventitia
Vasa Vasorum

- “Vessels of Vessels”
- Small arteries and veins in the walls of large arteries and veins
- Supply cells of tunica media and tunica externa
Aortic Arch

External carotid

Internal Carotid

Common Carotid

R. Vertebral

R. Axillary a.

R. Subclavian a.

L. Subclavian a.

Brachiocephalic Trunk
Axillary Artery

- R. Axillary a.
- Brachial a.
- Radial a.
- Ulnar a.
Right vertebral
Spinal cord, cervical vertebrae (right side); fuses with left vertebral, forming basilar artery after entering cranium via foramen magnum

Right common carotid

Left common carotid

Left vertebral

Right subclavian

Brachiocephalic trunk

Left subclavian

Right axillary
Muscles of the right pectoral region and axilla

Right brachial
To structures of the arm

Right radial
Forearm, radial side

Right ulnar
Forearm, ulnar side

ASCENDING AORTA

THORACIC AORTA
(see Fig. 21–24)

LEFT VENTRICLE

ABDOMINAL AORTA
(see Figs. 21–24, 21–25)
Circle of Willis

- Anterior cerebral
- Internal Carotid (cut)
- Middle cerebral
- Posterior communicating
- Posterior cerebral
- Basilar
- R. Vertebral
- L. Vertebral
Abdominal Aorta

- Celiac Trunk
- Superior Mesenteric
- Gonadal
- Inferior Mesenteric
- Renal A.
- Common Iliac
- External Iliac
- Internal Iliac
Abdominal Aorta

- Celiac Trunk
- Common Hepatic
- Left Gastric
- Splenic
- Superior Mesenteric
- Inferior Mesenteric
Thigh

Anterior

Posterior

External Iliac

Femoral

Deep Femoral
Lower Leg

- Femoral
- Popliteal
- Anterior tibial
- Posterior tibial
- Fibular
- Dorsalis Pedis
- Fibular
EXTERNAL ILIAC

Femoral (see Fig. 21–26)

Thigh

Deep femoral (see Fig. 21–26)

Hip joint, femoral head, deep muscles of the thigh

Popliteal

Leg and foot

Fibular

Posterior tibial

Anterior tibial

Connected by anastomoses of dorsalis pedis, dorsal arch, and plantar arch, which supply distal portions of the foot and the toes
Explanations:

- **Deep femoral**: Collects blood from the thigh.
- **Small saphenous**: Collects blood from superficial veins of the leg and foot.
- **Great saphenous**: Collects blood from the superficial veins of the lower limb.
- **Femoral**: Connects deep and superficial veins.
- **Popliteal**: Intermediate vein connecting deep and superficial veins.
- **Fibular**: Helps in the return of blood from the calf region.
- **Posterior tibial**: Important vein for the lower limb's venous return.
- **Anterior tibial**: Another important vein for the lower limb's venous return.

**KEY**

- Superficial veins
- Deep veins

**Note**:

- Extensive anastomoses interconnect veins of the ankle and foot.
The End