Circulation and Blood Vessels

Answers to Workbook Activities

A. Answer the following questions relating to circulation.

1. Name the two major circulatory systems.

The two major circulatory systems are the cardiopulmonary circulation and the systemic circulation.

2. Describe the three specialized systemic routes.

The three specialized systemic routes are the coronary circulation, which brings blood to the myocardium; the portal circulation, which takes blood from the organs of digestion to the liver through the portal vein; and the fetal circulation, in which the fetus obtains oxygen and nutrients from the mother’s blood.

3. Describe coronary circulation.

The coronary circulation brings oxygenated blood to the myocardium. Two branches come off the aorta: the right coronary artery and the left coronary artery. They encircle the heart muscle with tiny branches going to all parts of the heart muscle. Blood goes to capillaries, then to the coronary veins. Blood returns to the right atrium through the coronary sinus.

4. What special structure is on the posterior wall of the right atrium?

The special structure, the coronary sinus, is a pocket or trough in the wall of the right atrium into which the blood from the coronary veins returns to the right atrium.

5. In portal circulation, which veins form the portal vein?

Veins from the pancreas, stomach, small intestine, colon, and spleen form the portal vein.

6. Is arterial circulation related to portal circulation? If so, how?

No, arterial circulation brings oxygenated blood to the organs of digestion. Portal circulation is only involved with venous blood.

7. The blood in the portal vein goes to the liver. What is the effect of the liver on glucose and blood glucose concentration?

The liver removes excess glucose from the blood, converting it to glycogen. In the event of vigorous exercise/work or periods without nourishment, glycogen reserves will be changed back into glucose for energy. This detour ensures that the blood’s glucose concentration is kept within a relatively narrow range.

B.

1. Label the diagram of fetal circulation from the mother to the heart of the fetus and back to the mother. Place the names of the structures on the lines provided. Trace the flow of blood from the placenta to the umbilical arteries.

1. umbilical vein

2. ductus venosus

3. inferior vena cava

4. right atrium

5. foramen ovale

6. left atrium

7. ductus arteriosus

8. aortic arch

9. aorta

10. umbilical arteries

In fetal circulation, oxygenated blood comes through the placenta of the mother to the fetus via the umbilical vein.  Most of the blood joins the inferior vena cava by way of a small vessel called the ductus venosus and goes to the right atrium.  The remaining blood goes to the liver. The blood in the right atrium goes through an opening in the atrial septum called the foramen ovale and then goes into the left atrium.  Most of teh blood shunts into the systemic circulation through the ductus arteriosus which connects the pulmonary artery to the aorta.  The blood returns to the placenta through the umbilical arteries. The fetus obtains oxygen and nutrients from the mother's blood.

2. Describe the function of the ductus venosus, foramen ovale, and ductus arteriosus. Do these structures have a function in the general circulation of the infant at 6 months of age? Does any blood circulate to the developing lungs of the fetus?

The ductus venosus is a small vessel that connects the umbilical vein and inferior vena cava; it bypasses the liver.

The foramen ovale is an opening between the right and left atrium. The blood from the mother already contains oxygen; therefore it does not have to go to the lungs for oxygen.

The ductus arteriosus is a shunt between the pulmonary artery and the aorta; it takes the blood from the heart to the rest of the body.

All of these fetal structures close within 6 months after the birth of the baby.

Some blood goes into heart and lungs to nourish the developing organs.

C. Fill in the blanks to complete the following statements.

1. After the blood goes through the cardiopulmonary circulation, the blood then goes to the major artery, the aorta.

2. The first branch is the coronary artery, which takes blood to the heart. The aorta now forms an arch.

3. The right branch of the aortic arch is the brachiocephalic artery, which subdivides into the subclavian artery to the shoulder and the common carotid artery to the head and face.

4. The left branch of the aortic arch has two arteries, the left common carotid artery to the head and neck and the subclavian artery to the shoulder.

5. The arch turns downward and is called the descending aorta with the following arteries coming off as branches: the thoracic artery to the chest cavity and the celiac artery to the liver, spleen, stomach, and pancreas.

D. Select the letter of the choice that best completes the statement.

1. The pulmonary artery carries deoxygenated blood from the

b. right ventricle to the lungs.

2. The outer layer of the arteries is the tunica

a. adventitia.

3. The ability of the arteries to withstand a sudden large increase in pressure is accomplished by the

a. elasticity of the smooth muscles.

4. The ability of the arteries to dilate and constrict is accomplished by the

b. muscle cells being arranged in a circular pattern.

5. The capillaries are branches of the

a. metarterioles.

6. The thinnest of the capillary walls allows only \_\_\_\_\_\_\_ out of the capillary.

d. oxygen, metabolic wastes, nitrogenous material, and carbon dioxide

7. Blood flow through the capillaries is controlled by the

b. precapillary sphincters.

8. Which of the following is a true statement about arteries and veins?

d. The walls are thinner in veins than in arteries, and valves are present only in veins.

9. The contractions of skeletal muscle

b. assist in venous return.

10. Blood flow through the capillaries is influenced by

b. hydrostatic pressure.

E. Answer the following riddles, using the arteries from the list.

brachial celiac common iliac

dorsal pedalis external carotid femoral

internal carotid popliteal radial

vertebral

Who Am I?

1. I run up and down the back,

bringing blood to the central nervous system track. vertebral

2. You feel me often at your wrist;

running or jumping gives my numbers a lift. radial

3. I struggle to get to all the parts of the brain,

where intelligence and coordination reign. internal carotid

4. I run down and through the upper bone,

get cuffed around, please leave me alone! brachial

5. They call me common, I go from place to place;

I branch down the legs and into the pelvic space. common iliac

6. I am really at the end of the line.

My companion vein has an upward climb. dorsal pedalis

7. If you reach down behind your knee

check around and you are sure to feel me. popliteal

8. When you get embarrassed and your face turns red,

my vessels have dilated, up to the hair roots on your head. external carotid

9. I am hungry for nutrients from your food intake;

I am now undecided, which of the four roads should I take? celiac

10. I sometimes get plugged and blood does not get through;

the legs and the feet do not know what to do. femoral

F. a. Label the arteries in the following diagram.

Labels for the arteries are as follows:

1. right internal carotid artery

2. right external carotid artery

3. right and left common carotid arteries

4. right vertebral artery

5. right subclavian artery

6. left subclavian artery

7. brachiocephalic artery

8. aortic arch

9. right axillary artery

10. ascending aorta

11. common hepatic artery

12. left gastric artery

13. splenic artery

14. right brachial artery

15. superior mesenteric artery

16. left renal artery

17. right common iliac artery

18. right external iliac artery

19. left radial artery

20. left ulnar artery

21. left internal iliac artery

22. right digitalis artery

23. left deep palmar arch artery

24. left superficial palmar arch artery

25. right femoral artery

26. right popliteal artery

27. right posterior tibial artery

28. right anterior tibial artery

29. right peroneal artery

30. right dorsalis pedis artery

G. 1. Label the diagram layers of the walls of the arteries and veins and describe their structure.

The labels are as follows:

1. tunica interna or intima—fibrous connective tissue with bundle of smooth muscle

2. tunica media—muscle cells arranged in a circular pattern, which controls the artery’s dilation and constriction

3. tunica extrema—consists of three smaller layers of endothelium

2. Explain the difference between the structures in the arteries and veins.

The veins are considerably less elastic and muscular than the arteries. The walls of the veins are much thinner than those of the arteries. The thinner-walled veins can collapse when not filled with blood. Veins have valves along their length that allow the blood to flow in only one direction.

H. Label the veins in the following diagram.

1. right external jugular vein 14. inferior vena cava

2. right internal jugular vein 15. right common iliac vein

3. right and left brachiocephalic veins 16. right internal iliac vein

4. right subclavian vein 17. right external iliac vein

5. superior vena cava 18. left ulnar vein

6. right axillary vein 19. left radial vein

7. left cephalic vein 20. right palmar arch vein

8. right hepatic vein 21. left palmar digitalis vein

9. left brachial vein 22. right femoral vein

10. hepatic portal vein 23. right great saphenous vein

11. splenic vein 24. right popliteal vein

12. superior mesenteric vein 25. right posterior tibial vein

13. left renal vein 26. right anterior tibial vein

27. right peroneal vein

28. right dorsalis venous arch

I. Using the previous diagram as a guide, fill in the name of the vein that matches each description.

Popliteal or posterior tibial vein 1. Affected in varicose veins

Right dorsalis venous arch 2. Furthest branch in feet

Great saphenous vein 3. Largest vein in body

Left renal vein 4. From the kidney

Superior vena cava 5. Returns blood to right atrium

Right and left brachiocephal vein 6. Branches into the shoulder and axilla

Hepatic portal vein 7. Involved in portal circulation

Internal iliac vein 8. Blood from the bladder and reproductive organs

Mesenteric vein 9. Blood from small intestine and colon

Internal jugular vein 10. Blood from brain to superior vena cavan

J. Fill in the blanks to complete the statements on blood pressure and pulse.

1. The pressure measured as the heart contracts is the systolic pressure; the pressure measured as the heart relaxes is the diastolic pressure.

2. Pulse measures the alternating expansion and contraction of an artery as blood flows through it.

3. The pulse rate is usually the same as the heart rate.

K. Answer the following questions.

1. Take the blood pressure of two of your classmates. Record the data. Are they within normal range?

The normal blood pressure is 120/80.

3. What is pulse pressure?

Pulse pressure is the difference between the systolic and diastolic pressure.

L. The following questions relate to pulse points.

1. Take your pulse at the following pulse sites and describe their locations. See textbook Figure 14-11.

Pulse Point   Rate          L ocation

Temporal 68 to 72 slightly above the outer edge of the eye

Carotid 68 to 72 found in the neck

Brachial 68 to 72 at the crook of the elbow

Radial 68 to 72 at the wrist on the thumb side

Popliteal 68 to 72 behind the knee

Dorsalis pedis 68 to 72 on the anterior surface of the foot

2. Is there a difference in any of your readings?

Answers will vary.

M. Match the disorder in Column A with the explanation in Column B.

Column A Column B

d 1. aneurysm a. cramping in buttocks while walking

e 2. phlebitis b. bleeding in blood vessels in brain

i 3. hemorrhoids c. fatty buildup in artery

b 4. cerebral hemorrhage d. ballooning of an artery

j 5. varicose veins e. inflammation of veins

h 6. embolism f. bluish discoloration of skin

l 7. peripheral vascular disease (PVD) g. death of body tissue

a 8. claudication h. traveling blood clot

f 9. cyanosis i. varicose veins in the walls of the rectum

g 10. gangrene j. swollen veins

k. loss of elasticity

l. blockage of artery in legs

N. Compare the following pairs.

1. Arteriole/venule

The arteriole, the smallest branch of the arteries, carries oxygenated blood; the venule, the smallest branch of the veins, carries deoxygenated blood.

2. Phlebitis/thrombosis

Phlebitis is inflammation of a vein; thrombosis is the formation of a blood clot in a blood vessel.

3. Ischemia/gangrene

Ischemia is a temporary lack of oxygen to a body part; gangrene is the death of body tissue due to an insufficient blood supply.

4. Embolism/thrombus

An embolism is a traveling blood clot; a thrombus is a blood clot.

5. Transient ischemic attack/stroke

A TIA is a temporary interruption of blood flow to the brain; a stroke is a sudden interruption of blood flow to the brain, resulting in a loss of oxygen to brain cells, causing impairment of the brain tissue.

O. Label the diagram of affected sites and resulting complications of atherosclerosis.

The labels are as follows:

Affected site Potential complications

1. Cerebral arteries 1. a. Stroke, TIA, chronic ischemic attack

2. Carotid arteries 2. a. Stroke, ischemic attacks

3. Aorta 3. a. Aneurysm

4. Coronary arteries 4. a. Angina, myocardial infarction

5. Renal arteries 5. a. Hypertension

6. Iliac arteries 6. a. Peripheral vascular disease

7. Femoral arteries 7. a. Peripheral vascular disease

8. Tibial arteries 8. a. Peripheral vascular disease

P. Match each disease in the following list with the correct description.

aphasia hemiplegia

cyanosis hypoperfusion

dysphasia phlebitis

gangrene orthostatic hypotension

1. Death of body tissue due to an insufficient blood supply gangrene

2. Inadequate blood supply to organs and body systems hypoperfusion

3. Paralysis on one side of the body hemiplegia

4. The inability to say what one wishes to say dysphasia

5. A bluish discoloration of the skin due to lack of oxygen cyanosis

6. Loss of speech or memory aphasia

7. A drop in blood pressure that occurs when rising from   
a prone position to a standing position orthostatic hypotension

8. An inflammation of the lining of a vein phlebitis

Q. Complete the puzzle relating to cerebral vascular accidents.

1. Acronym for condition CVA

2. May be affected in one eye eyesight

3. Affected brain area causing left-sided hemiplegia right cerebrum

4. A CAT scan is one of these examination

5. Speech area of the brain Broca’s area

6. General term for conditions that predispose to CVA risk factors

7. Result of immobility atrophy

8. Affected brain area causing right-sided hemiplegia left cerebrum

9. Dizziness vertigo

10. Risk factor; vessel loses elasticity arteriosclerosis

11. Another name for condition stroke

12. Common site where clots form coronary artery

13. Patient’s complaint about limbs being affected useless

14. Changes necessary to reduce risk of CVA lifestyle

15. Risk factor due to plaque buildup atherosclerosis

16. Treatments necessary to return to activities of daily   
living after CVA rehabilitation

17. Loss of speech aphasia

18. Diagnostic test used to assess cause of stroke computerized axial

tomography

19. Of CVAs, 90% result from this clot

20. When the brain is deprived of oxygen, this is the result impairment

21. Inability to say what one wants to difficulty in speech

22. For treatment to be this, it must begin within 4 hours   
after stroke effective

23. Test to determine reflexes after CVA neuro-check

24. Where CVA places as a leading cause of death third

R. Explain the importance of the cardiovascular system to all other body systems in maintaining homeostasis.

The cardiovascular system plays a role in the maintenance of all body systems by carrying oxygen, nutrients, and hormones to all cells and carrying away cellular waste products and carbon dioxide for excretion by the body.

Applying Theory to Practice

1. Prepare a presentation for junior high school students regarding nursing careers, including registered nurses, nurse clinicians, licensed practical nurses, and nurse aides. Describe the educational requirements, the roles, and the future employment possibilities.

Refer to the Career Profiles in Chapter 14 in the textbook.

2. a. Why is hypertension called the “silent killer”?

Hypertension is called the “silent killer” because there are usually no symptoms.

b. What risk factors predispose people to hypertension?

Risk factors for hypertension include stress, smoking, being overweight, diets high in fats, and a family history of the disease.

c. What are the complications of hypertension?

A complication of hypertension is a stroke.

d. How can hypertension be prevented?

Hypertension can be prevented by using relaxation techniques, exercising, not smoking, reducing fat in the diet, and maintaining proper weight.

3. You are taking the blood pressure of a patient in the HMO where you are employed. The reading is 150/90. After she has rested for 5 minutes you retake her pressure. It is the same. The patient asks what her blood pressure is. When you tell her, she states it has never been that high. You suspect she may have “white coat” hypertension.

a. Describe “white coat” hypertension.

This phenomenon occurs only when a medical professional in a white coat or other medical clothing takes the blood pressure. It is thought that the stress of a medical examination increases the pressure; this is not usually true hypertension.

b. Does medication help this situation?

Medication is not effective in this situation.

c. How would you differentiate between true hypertension and “white coat” hypertension?

The best way to differentiate between “white coat” hypertension and true hypertension is to have the patient wear a device that measures the blood pressure over a 24-hour period.

4. Tony has had a series of minor transient ischemic attacks (TIAs). His family has done some research and is concerned that this may lead to a stroke.

a. What acronym is helpful to assess whether someone is having a stroke?

The acronym is FAST: Face—ask the person to smile and see if one side of the mouth droops down. Arms—ask the person to raise both arms, and watch to see if one arm drifts down. Speech—ask the person to speak a simple sentence or check for slurred speech. Time—if any symptoms are present, call for emergency help immediately.

b. The family also wants to know whether there will be a chance of a complete recovery if Tony does have a stroke. How would you respond?

See Medical Highlights: “How the Brain Heals After a Stroke” in Chapter 14 in the textbook.

5. As a paramedic, you must able to recognize the symptoms of shock. Define *shock.* What are the causes of and treatments for shock?

Shock or hypoperfusion refers to an inadequate blood flow to the organs and body systems. The organ that is most sensitive to a decrease in oxygen supply is the brain. After just 4 minutes of decreased blood flow, brain cells will suffer irreversible damage.

The causes of shock may be excessive bleeding or fluid loss. Shock may also be caused by a change in the size of the arteries and veins. Blood vessels may dilate, causing a decreased blood flow. Some cases of severe allergic reactions, infections, and loss of smooth muscle control may occur. The main cause is inadequate pumping of the heart.

Treatment is to determine the cause, replace fluid loss, combat infection and allergic reaction, and stabilize the heart.

Surf the Net

For additional information and interactive exercises, use the following key words:

• cardiopulmonary circulation

• specialized circulation—coronary, portal, fetal

• blood vessels—structure and function

• blood pressure—hypertension

• disorders of circulatory system—aneurysm, arteriosclerosis, atherosclerosis, blood clots, cerebral vascular accident (stroke), peripheral vascular disease

• aging effects on blood vessels

• career profile: EMT and paramedic