Guyton questions

Physiology final lectures 1-9

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وَذَا ٱلنُّونِ إِذ ذَّهَبَ مُغَٰضِبًا فَظَنَّ أَن لَّن نَّقۡدِرَ عَلَيۡهِ
فَنَادَىٰ فِي ٱلظُّلُمَٰتِ أَن لَّآ إِلَٰهَ إِلَّآ أَنتَ سُبۡحَٰنَكَ إِنِّي
كُنتُ مِنَ ٱلظَّٰلِمِينَ ﴿٨٧﴾ فَٱسۡتَجَبۡنَا لَهُۥ وَنَجَّيۡنَٰهُ
مِنَ ٱلۡغَمِّۚ وَكَذَٰلِكَ نُنجِي ٱلۡمُؤۡمِنِينَ ﴿٨٨﴾

Lectures 1&2 : vascular hemodynamics

Q1. In control conditions, flow through a blood vessel is 100 ml/min under a pressure gradient of 50 mm Hg.
What would be the approximate flow through the vessel after increasing the vessel diameter to four times normal, assuming that the pressure gradient was maintained at 50 mm Hg?

A) 300 ml/min
B) 1600 ml/min
C) 1000 ml/min
D) 16,000 ml/min
E) 25,600 ml/min

Ans : b

Q2. A 50-year-old woman has a renal blood flow of 1200 ml/min and hematocrit of 50. Her arterial pressure is 125 mm Hg and her renal venous pressure is 5 mm Hg. What is the total renal vascular resistance (in mm Hg/ml/min)?

A) 0.05
B) 0.10
C) 0.50
D) 1.00
E) 1.50

Ans : b

Q3. An increase in which of the following would be expected to decrease blood flow in a vessel?

A) Pressure gradient across the vessel
B) Radius of the vessel
C) Plasma colloid osmotic pressure
D) Viscosity of the blood
E) Plasma sodium concentration

Ans : D

Q4. Assuming that vessels A to D are the same length, which one has the greatest flow?

	Pressure Gradient	Radius	Viscosity
A)	100	1	10
B)	50	2	5
C)	25	4	2
D)	10	6	1

Ans : D

Q5. The diameter of a precapillary arteriole is increased in a muscle vascular bed. A decrease in which of the following would be expected?

A) Capillary filtration rate
B) Vascular conductance
C) Capillary blood flow
D) Capillary hydrostatic pressure
E) Arteriolar resistance

Ans : E

Q6. The tendency for turbulent blood flow is greatest in which of the following?

A) Aorta
B) Small arteries
C) Arterioles
D) Capillaries
E) Venules

Ans : A

Q7. Which of the following segments of the circulatory system has the highest velocity of blood flow?

A) Aorta
B) Arteries
C) Capillaries
D) Venules
E) Veins

Ans : A

Q8. Which of the following vessels has the greatest total cross-sectional area in the circulatory system?

A) Aorta
B) Small arteries
C) Capillaries
D) Venules
E) Vena cava

Ans : C

Q9. Under control conditions, flow through a blood vessels is 100 ml/min with a pressure gradient of 50 mm Hg.What would be the approximate flow through the vessel after increasing the vessel diameter by 50%, assuming that the pressure gradient is maintained at 50 mm Hg?

A) 100 ml/min
B) 150 ml/min
C) 300 ml/min
D) 500 ml/min
E) 700 ml/min

Ans : D
Note : The book question says “maintained at 100 mmHg,” but according to the answer key it should be 50 mmHg. Since pressure changes were not considered, it should stay “maintained” or otherwise the Ans would be 1000

Q10. In control conditions, flow through a blood vessel is 100 ml/min under a pressure gradient of 50 mm Hg.
What would be the approximate flow through the vessel after increasing the vessel diameter to four times normal, assuming that the pressure gradient was maintained at 50 mm Hg?

A) 300 ml/min
B) 1600 ml/min
C) 1000 ml/min
D) 16,000 ml/min
E) 25,600 ml/min

Ans : E

Lecture 3 : Arteries

Q1. Which part of the circulation has the highest compliance?

A) Capillaries
B) Large arteries
C) Veins
D) Aorta
E) Small arteries

Ans : C

Q2. A decrease in which of the following tends to increase pulse pressure?

A) Systolic pressure
B) Stroke volume
C) Arterial compliance
D) Venous return
E) Plasma volume

Ans : C

Q3. Blood flow to a tissue remains relatively constant despite a reduction in arterial pressure (autoregulation).

Which of the following would be expected to occur in response to the reduction in arterial pressure?

A) Decreased conductance
B) Decreased tissue carbon dioxide concentration
C) Increased tissue oxygen concentration
D) Decreased vascular resistance
E) Decreased arteriolar diameter

Ans : D

Q4. What would tend to increase a person's pulse pressure?

A) Decreased stroke volume
B) Increased arterial compliance
C) Hemorrhage
D) Patent ductus
E) Decreased venous return

Ans : D

Lecture 4 : Arterioles

Q1. Which blood vessel has the highest vascular resistance?

A) Aorta
B) Arteries
C) Capillaries
D) Venules
E) Arterioles

Ans : E

Q2. Autoregulation of tissue blood flow in response to an increase in arterial pressure occurs as a result of which of the following?

A) Decrease in vascular resistance
B) Initial decrease in vascular wall tension
C) Excess delivery of nutrients such as oxygen to the tissues
D) Decrease in tissue metabolism

Ans : C

Lecture 5 : Nervous control of the circulation

Q1. Moving from a supine to standing position results in:

A) Increased arterial pressure
B) Activation of arterial baroreceptors → ↑ sympathetic & ↓ parasympathetic activity
C) Increased renal blood flow
D) Decreased venous hydrostatic pressure
E) Decreased sympathetic nerve activity

Ans : B

Q2. Which of the following would be expected to occur during a Cushing reaction caused by brain ischemia?

A) Increase in parasympathetic activity
B) Decrease in arterial pressure
C) Decrease in heart rate
D) Increase in sympathetic activity

Ans : D

Q3. Which of the following changes would occur in response to an increase in atrial pressure?

A) Increased plasma levels of aldosterone
B) Increased plasma levels of angiotensin II
C) Decreased sodium excretion
D) Increased plasma atrial natriuretic peptide
E) Increased renal sympathetic nerve activity

Ans : D

Q4. Which of the following best describes the Cushing reaction?

A) It is a normal mechanism for regulating arterial pressure.
B) It becomes significant when arterial pressure is above normal.
C) It decreases total peripheral resistance.
D) It is a type of CNS ischemic response triggered by increased cerebrospinal fluid pressure.
E) It decreases sympathetic nervous system activity.

Ans : D

Q5. Which of the following would occur with an increase in atrial pressure of 10 mm Hg?

A) Increased venous return to the heart
B) Decreased vena cava hydrostatic pressure
C) Increased arterial pressure
D) Increased cardiac output
E) Decreased venous return to the heart

Ans : E

Q6. Atrial pressure increased by balloon catheter. What happens?

A) ↑ ANP
B) ↑ Angiotensin II
C) ↑ Aldosterone
D) ↑ Renal sympathetic nerve activity

Ans : A

Q7. An increase in atrial pressure results in which?

A) Decrease in plasma ANP
B) Increase in angiotensin II
C) Increase in aldosterone
D) Increase in sodium excretion

Ans : D

Q8. A 25-year-old man enters the hospital emergency department after severing a major artery during a farm accident.It is estimated that the patient has lost approximately 800 milliliters of blood. His mean blood pressure is 65 mmHg, and his heart rate is elevated as a result of activation of the chemoreceptor reflex. Which set of changes in plasma concentration would be expected to cause the greatest activation of the chemoreceptor reflex?

	Oxygen	Carbon Dioxide	Hydrogen
A)	↑	↑	↑
B)	↑	↓	↑
C)	↑	↓	↓
D)	↑	↑	↓
E)	↓	↓	↓
F)	↓	↑	↓
G)	↓	↑	↑
H)	↓	↓	↑

Ans : G

Lecture 6 : Blood pressure control

Q1. A 22-year-old man enters the hospital emergency department after severing a major artery in a motorcycle accident. It is estimated that he has lost approximately 700 milliliters of blood. His blood pressure is 90/55mm Hg. Which set of changes would be expected in response to hemorrhage in this man?

	Heart Rate	Sympathetic Nerve Activity	Total Peripheral Resistance
A)	↑	↑	↑
B)	↑	↓	↑
C)	↑	↓	↓
D)	↑	↑	↓
E)	↓	↓	↓
F)	↓	↑	↓
G)	↓	↑	↑
H)	↓	↓	↑

Ans : A

Q2. A healthy 28-year-old woman stands up from a supine position . Moving from a supine to a standing position results in a transient decrease in arterial pressure that is detected by arterial baroreceptors located in the aortic arch and carotid sinuses. Which set of cardiovascular changes is most likely to occur in response to activation of the baroreceptors?

	Mean Circulatory Filling Pressure	Strength of Cardiac Contraction	Sympathetic Nerve Activity
A)	↑	↑	↑
B)	↑	↓	↑
C)	↑	↓	↓
D)	↑	↑	↓
E)	↓	↓	↓
F)	↓	↑	↓
G)	↓	↑	↑
H)	↓	↓	↑

Ans : A

Q3. A healthy 60-year-old woman with a 10-year history of hypertension stands up from a supine position.Which set of cardiovascular changes is most likely to occur in response to standing up from a supine position?

	Sympathetic Nerve Activity	Parasympathetic Nerve Activity	Heart Rate
A)	↑	↑	↑
B)	↑	↑	↓
C)	↑	↓	↓
D)	↑	↓	↑
E)	↓	↓	↓
F)	↓	↓	↑
G)	↓	↑	↑
H)	↓	↑	↓

Ans : D

Q4. A 60-year-old woman has experienced dizziness for the past 6 months when getting out of bed in the morn-ing and when standing up. Her mean arterial pressure is 130/90 mm Hg while lying down and 95/60 while sitting . Which set of physiological changes would be expected in response to moving from a supine to an upright position?

	Parasympathetic Nerve Activity	Plasma Renin Activity	Sympathetic Activity
A)	↑	↑	↑
B)	↑	↓	↑
C)	↑	↓	↓
D)	↑	↑	↓
E)	↓	↓	↓
F)	↓	↑	↓
G)	↓	↑	↑
H)	↓	↓	↑

Ans : G

Q5. A 65-year-old man with a 10-year history of essential hypertension is being treated with an angiotensin converting enzyme (ACE) inhibitor. Which set of changes would be expected to occur in response to theACE inhibitor drug therapy?

	Plasma Renin Concentration	Total Peripheral Resistance	Renal Sodium Excretory Function
A)	↑	↑	↑
B)	↑	↑	↓
C)	↑	↓	↓
D)	↑	↓	↑
E)	↓	↓	↓
F)	↓	↓	↑
G)	↓	↑	↑
H)	↓	↑	↓

Ans : D

Q6. A decrease in the production of which of the following would most likely result in chronic hypertension?

A) Aldosterone
B) Thromboxane
C) Angiotensin II
D) Nitric oxide

Ans : D

Q7. Which set of changes would be expected to occur 2 weeks after a 50% reduction in renal artery pressure?

	Plasma Renin	Plasma Aldosterone Concentration	Glomerular Filtration Rate
A)	↑	↑	↑
B)	↑	↑	↓
C)	↑	↓	↓
D)	↑	↓	↑
E)	↓	↓	↓
F)	↓	↓	↑
G)	↓	↑	↑
H)	↓	↑	↓

Ans : B

Lecture 7 : special circulation

Q1. A healthy 27-year-old female medical student runs a 5K race. Which set of physiological changes is most likely to occur in this woman's skeletal muscles during the race?

	Arteriole Diameter	Vascular Conductance	Tissue Oxygen Concentration
A)	↑	↑	↑
B)	↑	↑	↓
C)	↑	↓	↓
D)	↑	↓	↑
E)	↓	↓	↓
F)	↓	↓	↑
G)	↓	↑	↑
H)	↓	↑	↓

Ans : B

Q2. Cognitive stimuli such as reading, problem solving, and talking all result in significant increases in cerebral blood flow. Which set of changes in cerebral tissue concentrations is the most likely explanation for the increase in cerebral blood flow?

	Carbon Dioxide	pH	Adenosine
A)	↑	↑	↑
B)	↑	↓	↑
C)	↑	↓	↓
D)	↑	↑	↓
E)	↓	↓	↓
F)	↓	↑	↓
G)	↓	↑	↑
H)	↓	↓	↑

Ans : B

Q3. If a person has been exercising for 1 hour, which organ will have the smallest decrease in blood flow?

A) Brain
B) Intestines
C) Kidneys
D) Non-exercising skeletal muscle
E) Pancreas

Ans : A

Q4. Which vasoactive agent is usually the most important controller of coronary blood flow?

A) Adenosine
B) Bradykinin
C) Prostaglandins
D) Carbon dioxide
E) Potassium ions

Ans : A

Q5. Which statement about coronary blood flow is most accurate?

A) Normal resting coronary blood flow is 500 ml/min
B) The majority of flow occurs during systole
C) During systole, the percentage decrease in subendocardial flow is greater than the percentage decrease in epicardial flow
D) Adenosine release will normally decrease coronary flow

Ans : C

Q6. Which condition normally causes arteriolar vasodilation during exercise?

A) Decreased plasma potassium ion concentration
B) Increased histamine release
C) Decreased plasma nitric oxide concentration
D) Increased plasma adenosine concentration
E) Decreased plasma osmolality

Ans : D

Q7. At the onset of exercise, the mass sympathetic nervous system strongly discharges. What would you expect to occur?

A) Increased sympathetic impulses to the heart
B) Decreased coronary blood flow
C) Decreased cerebral blood flow
D) Reverse stress relaxation
E) Venous dilation

Ans : A

Q8. Which event normally occurs during exercise?

A) Arteriolar dilation in non-exercising muscle
B) Decreased sympathetic output
C) Venoconstriction
D) Decreased release of epinephrine by the adrenals
E) Decreased release of norepinephrine by the adrenals

Ans : C

Q9. Which condition often occurs in compensated hemor-rhagic shock? Assume systolic pressure is 48 mm Hg.

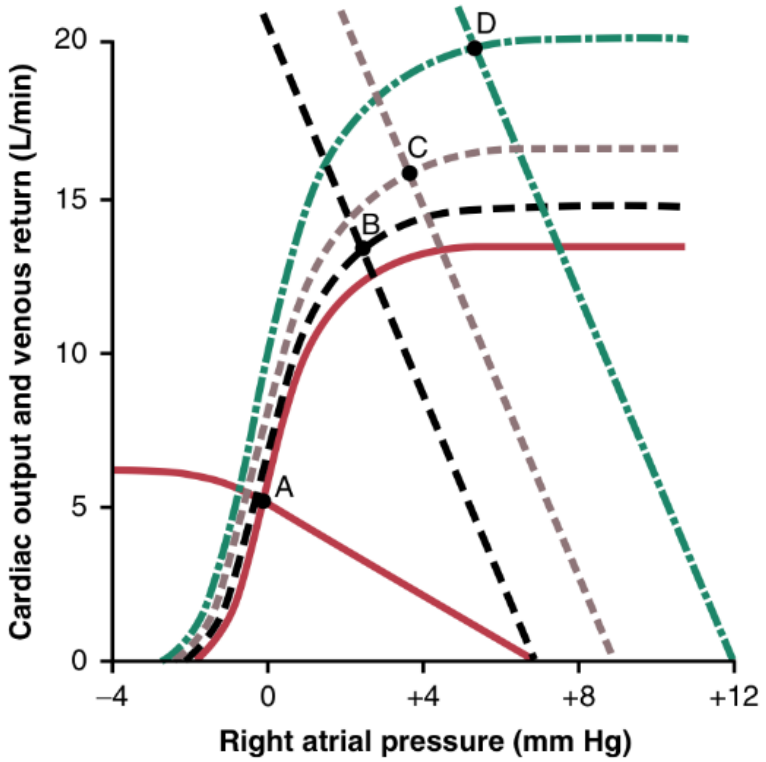
A) Decreased heart rate
B) Stress relaxation of veins
C) Decreased ADH release
D) Decreased absorption of interstitial fluid through the capillaries
E) Central nervous system (CNS) ischemic response

Ans : E

Lecture 8 : veins

Q1. In the above figure, for the cardiac output and venous return curves defined by the solid red lines (with the equilibrium at A), which of the following options is true?

A Mean systemic filling pressure is 12 mm Hg
B) Right atrial pressure is 2 mm Hg
C) Resistance to venous return is 1.4 mm Hg/L/min
D) Pulmonary arterial flow is approximately 7 L/min
E) Resistance to venous return is 0.71 mm Hg/L/min



Ans : C

Q2. During maximal sympathetic output, several changes occur. Which one is correct?

A) Venous return increases because MSFP increases more than resistance to venous return
B) Venous return decreases because venous resistance greatly increases
C) Venous return does not change
D) Venous return decreases because MSFP decreases
E) Venous return is entirely dependent on heart rate

Ans : A

Q3. A 30-year-old man is resting, and his sympathetic out-put increases to maximal values. Which set of changes would be expected in response to this increased sympathetic output?

	Resistance to Venous Return	Mean Systemic Filling Pressure	Venous Return
A)	↑	↑	↑
B)	↑	↓	↑
C)	↑	↓	↓
D)	↑	↑	↓
E)	↓	↓	↓
F)	↓	↑	↓
G)	↓	↑	↑
H)	↓	↓	↑

Ans : A

Q4. What normally causes the cardiac output curve to shift to the left along the right atrial pressure axis?

A) Surgically opening the chest
B) Severe cardiac tamponade
C) Breathing against a negative pressure
D) Playing a trumpet
E) Positive pressure breathing

Ans : C

Q5. What would decrease venous hydrostatic pressure in the legs?

A) Increase in right atrial pressure
B) Pregnancy
C) Movement of leg muscles
D) Presence of ascitic fluid in the abdomen

Ans : C

Lecture 9 : capillaries and lymphatics

Q1. The diameter of a precapillary arteriole is decreased in a muscle vascular bed. Which change is expected?

A) Decreased capillary filtration rate
B) Increased interstitial volume
C) Increased lymph flow
D) Increased capillary hydrostatic pressure
E) Decreased arteriolar resistance

Ans : A

Q2. An increase in which of the following would tend to increase lymph flow?

A) Hydraulic conductivity of the capillary wall
B) Plasma colloid osmotic pressure
C) Capillary hydrostatic pressure
D) Arteriolar resistance
E) A and C

Ans : E

Q3. An increase in which of the following tends to decrease capillary filtration rate?

A) Capillary hydrostatic pressure
B) Plasma colloid osmotic pressure
C) Interstitial colloid osmotic pressure
D) Venous hydrostatic pressure
E) Arteriolar diameter

Ans : B

Q4. A decrease in which tends to increase lymph flow?

A) Capillary hydrostatic pressure
B) Interstitial hydrostatic pressure
C) Plasma colloid osmotic pressure
D) Lymphatic pump activity
E) Arteriolar diameter

Ans : C

Q5. A nitric oxide donor is infused into the brachial artery of a 22-year-old man. Which set of microcirculatory changes would be expected in the infused arm?

	Capillary Hydrostatic Pressure	Interstitial Hydrostatic Pressure	Lymph Flow
A)	↑	↑	↑
B)	↑	↑	↓
C)	↑	↓	↓
D)	↑	↓	↑
E)	↓	↓	↓
F)	↓	↓	↑
G)	↓	↑	↑
H)	↓	↑	↓

Ans : D

Q6. Using the following data, calculate the filtration coefficient for the capillary bed.

A) 10 ml/min/mm Hg
B) 15 ml/min/mm Hg
C) 20 ml/min/mm Hg
D) 25 ml/min/mm Hg
E) 30 ml/min/mm Hg

Plasma colloid osmotic pressure = 30 mm Hg
Capillary hydrostatic pressure = 40 mm Hg
Interstitial hydrostatic pressure = 5 mm Hg
Interstitial colloid osmotic pressure = 5 mm Hg
Filtration rate = 150 ml/min
Venous hydrostatic pressure = 10 mm Hg

Ans : B

Q7. Listed below are the hydrostatic and oncotic pressures within a microcirculatory bed.

What is the filtration rate (ml/min) of the capillary wall?

A) 100
B) 150
C) 200
D) 250
E) 300

Plasma colloid osmotic pressure = 25 mm Hg
Capillary hydrostatic pressure = 25 mm Hg
Venous hydrostatic pressure = 5 mm Hg
Arterial pressure = 80 mm Hg
Interstitial hydrostatic pressure = −5 mm Hg
Interstitial colloid osmotic pressure = 5 mm Hg
Filtration coefficient = 15 ml/min/mm Hg

Ans : B

Q8. Listed below are the hydrostatic and oncotic pressures within a microcirculatory bed.

What is the filtration rate (ml/min) of the capillary wall?

A) 25 ml/min
B) 50 ml/min
C) 100 ml/min
D) 150 ml/min
E) 200 ml/min

Plasma colloid osmotic pressure = 25 mm Hg
Capillary hydrostatic pressure = 25 mm Hg
Venous hydrostatic pressure = 5 mm Hg
Arterial pressure = 80 mm Hg
Interstitial fluid hydrostatic pressure = −5 mm Hg
Interstitial colloid osmotic pressure = 10 mm Hg
Capillary filtration coefficient = 10 ml/min/mm Hg

Ans : D


سُبْحَانَ اللهِ
وَالحَمْدُ للهِ
وَلَا إِلَهَ إِلَّا اللهُ
وَاللهُ أَكْبَرُ
وَلَا حَوْلَ وَلَا قُوَّةَ إِلَّا بِاللهِ
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