Occupational Therapy Physiology, Summer 2002

Examination 3

August 19, 2002

There are 20 questions and each question is worth 5 points for a total of 100 points.

Dr. Heckman's section is questions 1-14 and is worth a total of 70 points.

Dr. Driska's section is questions 15-20 and is worth a total of 30 points.

Make sure you have a complete examination and that your name is on each page.

You may not consult your notes or books.

You may use a calculator.

You have 1 hour.

Please show all your work.

Turn in your complete examination at the end of the exam period.

Good luck!
Dr. Heckman’s instructions:
Please place your name on all of the pages of the exam, answer the following questions, show all of your work and turn in the exam. At most, several sentences are all that are required to answer the short answer questions.

1. If afterload is increased, with no change in either preload or contractility, what will the effect be on stroke volume?

STROKE VOLUME WILL DECREASE

2. In the space provided below, draw a single pressure-volume loop which demonstrates a decrease in contractility with no change in either preload or afterload.

3. Explain why wearing support hose reduces ankle swelling in patients who need to stand for long periods.

SUPPORT HOSE 1) DECREASES THE COMPLIANCE OF THE VEINS AND REDUCES THE VOLUME OF BLOOD WHICH CAN BE STORED IN THE VEINS, 2) REDUCES CAPILLARY FILTRATION BY INCREASING INTERSTITIAL HYDROSTATIC PRESSURE

4. Explain why the mean blood pressure is not a good index of how much blood has been lost during hemorrhage.

A LARGE VOLUME OF BLOOD CAN BE LOST WITH LITTLE CHANGE IN BLOOD PRESSURE BECAUSE THE BARORECEPTOR REFLEX IS ABLE TO COMPENSATE FOR BLOOD LOSS BY INCREASING HR, TPR, AND CONTRACTILITY.
5. List two direct, uncompensated, effects of going rapidly from a supine to a standing position.

BLOOD VOLUME REDISTRIBUTED FROM THORAX INTO LEG VEINS
REDUCED PRELOAD (EDV)
REDUCED STROKE VOLUME
REDUCED CARDIAC OUTPUT
REDUCED BLOOD PRESSURE

6. After examining the above figure answer the two questions found below.

Is there blood flow? Yes
Is the person standing? No

7. Explain what happens to the arterial oxygen difference \((A-V)O_2\) during exercise. Be sure to explain what happens to the arterial oxygen content \((A)\) and the mixed venous oxygen content \((V)\).

\[A \quad \text{NO CHANGE} \]
\[V \quad \text{DECREASES} \]
\[(A-V)O_2 \quad \text{INCREASES} \]

8. Define the term autoregulation.

THE PROCESS WHICH MAINTAINS A CONSTANT BLOOD FLOW TO A TISSUE OR ORGAN DESPITE A CHANGE IN BLOOD PRESSURE
9. Explain the cause of the pulmonary edema which is often found in patients in severe heart failure?

HEART FAILURE RESULTS IN AN INCREASE IN DIASTOLIC LEFT VENTRICULAR PRESSURES. THIS PRESSURE IS REFLECTED BACK INTO THE LEFT ATRIUM, THE PULMONARY VEINS AND INTO THE PULMONARY CAPILLARIES. THIS RISE IN PULMONARY CAPILLARY HYDROSTATIC PRESSURE INCREASES THE RATE OF FILTRATION TO A LEVEL HIGHER THAN CAN BE ACCOMMODATED BY THE LUNG LYMPHATICS. THE HIGH RATE OF FILTRATION CAUSES PULMONARY EDEMA.

10. Explain what happens during dynamic exercise which allows the heart muscle (the myocardium) to have a supply of oxygen adequate to meet its demand for oxygen.

INCREASED CORONARY BLOOD FLOW

11. What happens to the activity of the vasomotor center during hemorrhage?

INCREASE

12. How much pressure must the left ventricle develop in order to begin to eject the stroke volume?

A LEFT VENTRICULAR PRESSURE 2-3 MM HG ABOVE AORTIC PRESSURE

13. List two ways in which the ejection fraction can be increased.

INCREASE IN CONTRACTILITY
DECREASE IN AFTERLOAD

14. Explain the mechanisms which cause the cardiac output to increase during exercise

INCREASED HEART RATE AND CONTRACTILITY
15. Estimate the volumes of the body fluid compartments for a normal woman who weighs 50 kg. Place your answers in the table below.

<table>
<thead>
<tr>
<th>Fluid compartment</th>
<th>Volume, liters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total body water</td>
<td>30</td>
</tr>
<tr>
<td>Intracellular Fluid (ICF)</td>
<td>20</td>
</tr>
<tr>
<td>Extracellular (ECF) Fluid</td>
<td>10</td>
</tr>
<tr>
<td>Interstitial Fluid (ISF)</td>
<td>7.5</td>
</tr>
<tr>
<td>Plasma Volume</td>
<td>2.5</td>
</tr>
</tbody>
</table>

16. A man who has an intracellular fluid (ICF) volume of 36 liters and an extracellular fluid (ECF) volume of 18 liters drinks 5.4 liters of pure water. Calculate his new fluid volumes. (You should assume that all the water is absorbed from his GI tract and that his kidneys do not eliminate the excess water.)

His new intracellular fluid (ICF) volume is 39.6 liters.

His new extracellular fluid (ECF) volume is 19.8 liters.

17. A normal woman in a research study is given 1 liter of isotonic NaCl intravenously. How will the volume of her body fluid compartments below change? (You should assume her kidneys do not eliminate the excess water.)

- Her plasma volume will: increase
- Her interstitial fluid volume will: increase
- Her extracellular fluid volume will: increase
- Her intracellular fluid volume will: increase

Her plasma volume will: decrease stay the same
Her interstitial fluid volume will: decrease stay the same
Her extracellular fluid volume will: decrease stay the same
Her intracellular fluid volume will: decrease stay the same
18. A normal man eats 200 millimols of NaCl without drinking any water. Assume that all the salt has been absorbed from his GI tract, that any osmotic movement of water across the cell membrane has occurred, and that his kidneys have not yet eliminated the excess salt. What will happen to each variable below (increase, decrease, or stay the same)?

A. total body water content stay the same
B. volume of the extracellular fluid (ECF) increase
C. volume of the intracellular fluid (ICF) decrease
D. osmolarity of the extracellular fluid (ECF) increase
E. osmolarity of the intracellular fluid (ICF) increase

19. Define the renal process called reabsorption. Your answer should state the direction of the movement (blood to tubular fluid, or tubular fluid to blood), and should state which of the two sets of capillaries are involved.

Reabsorption is the movement of water and solutes from the tubular fluid in the kidney tubules into the blood in the peritubular capillaries.

20. Which solute, present in the plasma but not in the interstitial fluid, can cause movement of water from the interstitial fluid into the plasma by osmosis?

plasma proteins