Kaplan USMLE Step 1 prep: Man is dizzy when waking up

MAR 2, 2020

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If you’re preparing for the United States Medical Licensing Examination® (USMLE®) Step 1 exam, you might want to know which questions are most often missed by test-prep takers. Check out this example from Kaplan Medical, and read an expert explanation of the answer. Also check out all posts in this series.

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This month’s stumper

A healthy 62-year-old man comes to the physician because of dizziness, especially after getting up from bed in the morning. He is a nonsmoker with a five-year history of mild hypertension. His treatment regimen is hydrochlorothiazide and a salt-restricted diet. On physical examination, his mucous membranes are dry and his skin shows slightly decreased turgor.

Which of the following cardiovascular changes is most likely to occur as he stands up from a supine position?

A. Decreased myocardial contractility.

B. Decreased systemic vascular resistance.

C. Increased cerebral blood flow.

D. Increased heart rate.

E. Reflexive venodilation.

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The correct answer is D.

Kaplan Medical explains why

Our patient's dizziness is due to orthostatic hypotension secondary to dehydration and hypovolemia. He has insufficient fluid volume (sometimes seen in patients taking diuretics) to adequately maintain mean arterial pressure (MAP) and cerebral perfusion pressure, resulting in light-headedness and/or syncope. Increase heart rate is part of an autonomic reflex (baroreflex) that attempts to compensate for the pressure drop.

Standing after having been reclining in bed precipitates the following train of events:

- Gravity forces blood downwards, trapping it in the highly compliant veins of the lower extremities.
- ? MAP ? ? carotid sinus and aortic pressure, sensed by baroreceptors  ? baroreflex

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Baroreceptors communicate via **CN IX** (glossopharyngeal nerve) and **CN X** (vagal nerve) to medulla and baroreflex is affected via parasympathetic (CN X) and sympathetic efferents.

**Parasympathetic activity**
- Heart rate
- CO

**Sympathetic activity**
- Heart rate
- Myocardial inotropy
- Systemic vascular resistance
  - MAP (MAP = CO times SVR)
- Venoconstriction
- Preload
- CO

Even with the autonomic responses described above, hypovolemia means that the patient is unable to restore MAP sufficiently fast to avoid dizziness upon standing.

**Why the other answers are wrong**

**Choice A:** Standing leads to a reflex increase in myocardial contractility, not a decrease. A decrease would further reduce MAP.

**Choice B:** Systemic vascular resistance increases, not decreases upon standing. Constriction of resistance vessels limits outflow from the arterial system, thereby helping to preserve MAP in the face of reduced CO.

**Choice C:** Cerebral blood flow decreases upon standing due a fall in MAP and cerebral perfusion pressure. Patients with orthostatic hypotension may be forced to sit and put their head between their knees in order to restore cerebral flow and avoid syncope.

**Choice E:** A baroreflex involves reflex venoconstriction, not venodilation. Gravity tends to trap blood in the lower extremities, forcing the highly compliant veins to dilate to accommodate the blood volume, but this is a passive process, not a reflex. Venoconstriction helps offset this effect by limiting venous capacity.

**Tips to remember**
- When a person stands erect after having been lying or sitting, blood is forced downward into the lower extremities by gravity.
- Venous return and arterial pressure fall, triggering a baroreflex. Sympathetic outflow increases and parasympathetic outflow decreases.
Heart rate, myocardial contractility, systemic vascular resistance, and venous return all increase.

Dizziness and syncope reflect a transient drop in cerebral perfusion pressure.

For more prep questions on USMLE Steps 1, 2 and 3, view other posts in this series.