2016-2-16 Describe baroreceptors and their role in the control of blood pressure. (62% pass)

1. High Pressure Baroreceptor (HP BR)
   - Carotid sinus and aortic arch receptors
     - Detects > 5-10 % change in plasma volume
     - ↓ Plasma volume → Increased central SNS tone and decreased PSNS tone
   - Sensor:
     - Stretch receptor: ↑ distension of vessel → ↑ discharge rate
     - Threshold > 60mmHg → normally has baseline tone.
     - Located at Carotid Sinus and Aortic Arch
     - Spray like visceral nerve endings
     - Transmitted by:
       - Unmyelinated C-fibres (most receptors)
       - Myelinated A-fibres (↑ sensitivity at lower BP)
       - Individual fibres have narrow BP range
     - Increased reponsiveness to pulsitile rather than continuous flow
   - Afferent signal:
     - Carotid sinus → Nerve of Hering → CN9
     - Aortic Arch → CN10 → NTS
     - Both then divide to:
       - Stimulatory afferents → ↑ Medullary vagal outflow
       - Inhibitory afferents → ↓ RVLM SNS outflow
   - Outcome:
     - ↑'d distension → ↓'d HR/Contractility/SVR
     - Provides strict negative feedback to Δ's in CO
2. Low Pressure Baroreceptors (LP BR)
   - Location
     - Located at junction of return vessels and atria, vetricular walls, pulmonary vessles
     - Throughout the peripheral vasculature (esp kidney)
   - Sensor:
     - Stretch receptor: ↑ distension of vessel → ↑ discharge rate
     - Detect > 10% decrease in plasma volume as decreased atrial stretch
     - ↓ Discharge rate with
       - Reduced ANP release
       - Increase SNS output
   - 2 types
     - A receptors → fire at atrial contraction (a wave)
     - B type → fire at atrial filling (v wave)
   - Outcome
     - ↓ PL → ↓ CO → ↓BR discharge rate
       - Medulla afferents cause
         - ↓ SNS (NA) and ↑PSNS (RVLM) outflow → peripheral vascular vaso and venodilation
         - ↓ SNS activity to kidney → ↓ Na/H2O conservation
         - ↑ SNS activity to sinus node
       - Hypothalamic afferents cause
         - → ↓ ADH release and ↓ Thirst
     - ↑ contractility/HR/SV/CO
     - ↑ SVR → autotransfusion and ↑ perfusing pressure (but ↑AL)

Examiner Comments

This is a core topic and a detailed knowledge was expected. Baroreceptors are stretch receptors located in the walls of the heart and blood vessels and are important in the short term control of blood pressure. Those in the carotid sinus and aortic arch monitor the arterial circulation. Others, the cardiopulmonary baroreceptors, are located in the walls of the right and left atria, the pulmonary veins and the pulmonary circulation. They are all stimulated by distention and discharge at an increased rate when the pressure in these structures rises. Better answers provided some detail on the innervation for these receptors. It was expected candidates would describe that increased baroreceptor discharge inhibits the tonic discharge of sympathetic nerves and excites the vagal innervation of the heart. This results in vasodilation, venodilation, a drop in blood pressure, bradycardia and a decreased cardiac output.

Some candidates had a major misunderstanding around the purpose of "low pressure baroreceptors" with many believing that these are the ones that respond to lower blood pressures, while the "high pressure baroreceptors" respond to higher blood pressures.