Q18 September 2009
Outline the physiology of, and factors which regulate levels of angiotensin.

Angiotensin is a peptide hormone that is important in regulating blood pressure. It is part of the renin-angiotensin system.

Renin is an enzyme released by the juxtaglomerular cells in the kidney, in response to decreased arterial blood pressure. Renin (half-life ~80 mins) acts on the plasma protein angiotensinogen to release angiotensin I (a 10-amino acid peptide). Angiotensin I has mild vasoconstrictor properties, but not enough to cause significant changes in circulation. Angiotensin I is converted into angiotensin II by angiotensin-converting enzyme in the lungs, where ACE is present in the lung vascular endothelium. Angiotensin II only remains in the blood for 1-2 minutes before being inactivated by multiple blood and tissue enzymes called angiotensinases.

Angiotensin II effects

- Powerful vasoconstrictor
    - Constriction of arterioles raises total peripheral resistance, increasing arterial pressures
    - Mild constriction of veins increases venous return
- Direct effects on kidneys to cause renal retention of salt and water
    - Constriction of renal arterioles → decreased fluid filtered through glomeruli (decreased GFR)
    - Decreased pressure in peritubular capillaries → rapid reabsorption of fluid from tubules
    - Direct action on tubular cells to increase tubular reabsorption of sodium and water
- Preferential constriction of efferent arteriole
    - Increased glomerular hydrostatic pressure → conserves GFR
- Angiotensin II is a powerful stimulator of aldosterone secretion by the adrenal glands
- Releases norad from postganglionic sympathetic terminals
- Causes tissue growth
- Half-life of ATII ~ 8 mins

Factors regulating angiotensin levels

- Any mechanism that increases or decreases renin production will increase or decrease angiotensin levels
    - JG cells of the afferent arteriole act as intrarenal baroreceptors
        - Increased renal arterial pressure inhibits renin release
        - Decreased renal arterial pressure (e.g. hypovolaemia, renal artery stenosis) stimulates renin release
    - Increased distal delivery of Na^+ to the macula densa cells of the thick ascending Loop of Henle causes decreased renin secretion; decreased distal delivery of Na^+ causes increased renin secretion → pathway mediated by PGE_2
    - Sympathetic stimulation
        - JG cells are innervated by sympathetic nerve fibres
        - Increased sympathetic activity causes increased renin activation
        - Decreased sympathetic activity causes decreased renin activation
- Negative feedback from high circulating ATII or vasopressin