Lec 3

Control of GFR & Renal Blood flow

- GFR & RBF help maintain homeostasis, so they must be regulated ... there are 2 mechanisms: Neurohumoral (extrinsic) Local (intrinsic)

Neurohumoral

- includes nervous & endocrine system
- Response to each regulator depends on type & density of receptors ... I will say if the receptors are more dense in afferent or efferent.

Sympathetic nervous system / Catecholamines

- Kidneys only supplied by Sympathetic that produce catecholamines like epinephrine & norepinephrine → Vasoconstrictors
- work on adrenergic Receptors mainly in afferent arteriole
- caused by strong sympathetic stimulation → hemorrhage, or danger
- ↓ RBF, ↓ GFR

Angiotensin II

- most important vasoconstrictor ... on efferent
- hypotension → renin produced by juxtaglomerular cells → angiotensinogen to angiotensin I → Angiotensin II by ACE
- prevents ↓ in GFR ... so it brings GFR back to normal when there is hypotension
- ↑ GFR
- Prevents low BP & GFR, so problem w/ ATII leads to

hypertension

Prostaglandins

- local vasodialator on afferent
- ↑ hydrostatic pressure, ↑ GFR & RBF

Endothelial derived Nitric oxide (NO)

- local vasodialator of afferent, produced by juxtaglomeralar cells & endothelial
- ↑ GFR & RBF

Endothelin

- harmful local vasoconstrictor on afferent
- ↓ GFR & RBF

* of all 5, only ATII works on efferent

Local Control (Intrinsic)

- Autoregulation of GFR & RBF automatically in kidney w/out nervous or endocrine control

* more important than extrinsic

Myogenic Mechanism (Autoregulation)

- ↑ arterial pressure streches vascular walls → Ca^+ goes from extracellular space into cell → smooth muscle cells contract → ↑ resistance → prevents excessive ↑ in RBF & GFR

* Resists Stretch

Macula Densa feedback (tubuloglomerular feedback) (Autoregulation)

- Senses change in NaCl concentration & ensures constant delivery of NaCl to distal tubule, & prevents spurious fluctuations

* different affect on afferent

- ↑ GFR means more NaCl filtered ... NaCl goes to distal tubules, then to macula densa

- macula densa sends feedback (cross talk) to juxtaglomerular cells to ↓ NO on afferent arterials, so GFR & RBF are reduced back to normal

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- ↓ GFR → less filtered NaCl → crosstalk btwn macula & juxtaglomerular cells to ↑ Renin → constriction of efferent → GFR ↑ back to normal

notes

function of the 2 autoregulation systems is to maintain normal GFR & RBF dispite changes in BP

to maintain O_2 & nutrient distribution & release waste & for precise control of H_2O excretion & solutes

So changes in Renal Arteriol pressure causes sudden & temporary changes to GFR & RBF, then they go back to normal

Angiotensin II

- contributes to GFR but not RBF autoregulation
- prevents drop of GFR
- some drugs inhibit ATII synthesis or ATII receptor binding, which severly affects RBF & GFR

Other factors affecting GFR

- fever / pyrogen . High protein diet, glucocorticoids, hyperglycemia

↑ GFR

- Aging & low protein diet → ↓ GFR

Importance of autoregulation

If arterial pressure is normal

GFR = 125 , reabsorption = 124 , urine = 1mL

If ↑ Arterial Pressure / poor autoregulation & Constant Reabsorption

GFR = 150 , Reabsorption = 124 , urine = 26 ml

If ↑ Arterial pressure / good autoregulation & constant Reabsorption

GFR = 130 , Reabsorption = 124 , urine = 5 ml

↑ AP / good autoregulation & adaptive tubular reabsorption

GFR = 130 , Reabsorption = 128.8 , urine = 1.2