Renovascular Hypertension for the USMLE Step One Exam

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Renovascular Disorders: Renal Artery Stenosis

- **Background**
  - Prototypic condition for hypoperfusion of one kidney
Renovascular Disorders: *Renal Artery Stenosis*

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![Diagram of renin-angiotensin-aldosterone system and vasoconstriction](image)
Renovascular Disorders: *Renal Artery Stenosis*

- **Background**
  - Prototypic condition for hypoperfusion of one kidney

**Pathology Macro/Micro**

**Physiologic Response**

**Differential Diagnosis**

**Physiologic Response**

*Reduction (in renal mass)*  
*Compensatory*
Renovascular Disorders: *Renal Artery Stenosis*
Renovascular Disorders: *Renal Artery Stenosis*

- **Presentation:**
  - HTN in *(older)* patient with *vasculopathy/ASCVD* (i.e. CAD, PVD, TIA/carotid)
  - ‘Play Media’ → Abdominal Bruit (in a vasculopath)
Renovascular Disorders: *Renal Artery Hypoperfusion*

- **Presentation:**
  - Young patient with refractory HTN; angiogram shown
    - Beaded appearance
  - Young Asian woman without a palpable pulse; angiogram shown
    - *Segmental* stenosis with aneurysm formation

![Fibromuscular dysplasia](image1)

![Takayasu's Arteritis](image2)
Renovascular Disorders: *Renal Artery Stenosis*

- **Pathology**
  - **Gross:** unilateral shrunken kidney
  - **Micro:** atrophy (tubules, glomeruli), fibrosis (interstitium, tubules)
Renovascular Disorders: *Renal Artery Stenosis*

**Physiologic Derivatives**
- What is RAA doing in the hypoperfused kidney? **Activated**
- What is RAA doing in contralateral kidney? **Suppressed**
- What happens to the filtration fraction? Balanced (reduced GFR and RPF)
Renovascular Disorders: *Renal Artery Stenosis*

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Patient presents with condition associated with decreased effective circulating volume (ECV). They pop a couple of Aleve. What happens?
Renovascular Disorders: *Renal Artery Stenosis*

- **Physiologic Derivatives**
  - What is RAA doing in the hypoperfused kidney? *Activated*
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  - What happens to the filtration fraction? *Balanced* (reduced GFR and RPF)

Patient presents with condition associated with decreased effective circulating volume (ECV). They pop a couple of Aleve. What happens?

Filtration fraction is unchanged but failure to vasodilate precipitates acute kidney injury (AKI).
PGE mediated vasodilation

Interstitial Nephritis

Papillary Necrosis
Renovascular Disorders: Renal Artery Stenosis

- **Background**
  - Prototypic condition for hypoperfusion of one kidney

- **Presentation**
  - HTN in (older) patient with atherosclerosis/vasculopathy (i.e. CAD/CABG, TIA/carotid)
  - ‘Play Media’ → Abdominal Bruit (in a patient with vasculopathy)
  - Fibromuscular dysplasia/Takayasu - younger (female) patient

- **Pathology**
  - Gross: unilateral shrunken kidney
  - Micro: atrophy (tubules, glomeruli), fibrosis (interstitium, tubules)

- **Derivatives**
  - What is RAA doing in that kidney? Activated
  - What is RAA doing in contralateral kidney? Suppressed
  - What happens to the filtration fraction? No Δ (balanced reduction in GFR and RPF)
Fibromuscular Dysplasia
(Non-inflammatory, non-atherosclerotic angiopathy)
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(Non-inflammatory, non-atherosclerotic angiopathy)

• **Background:**
  • Common cause of renovascular HTN in *children* and *young adults*.
  • *May be bilateral AND present in other arteries (carotid/vertebral)*
  • **When to suspect:**
    • HTN that is severe accelerating or refractory in a young patient.
    • Bruit may be present
    • Significant drop in GFR (↑ Cr) with initiation of ACE-I (ATII dependence)

Similar *physiology* and *presentation* to RAS (so *questions can overlap*) **EXCEPT** these are younger patients with different pathology, arteriogram and lack of vasculopathy/ASCVD
Fibromuscular Dysplasia
(Non-inflammatory, non-atherosclerotic angiopathy)

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  - Common cause of renovascular HTN in children and young adults.
  - May be bilateral AND present in other arteries (carotid/vertebral)
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Similar physiology and presentation to RAS (so questions can overlap) EXCEPT these are younger patients with different **pathology, arteriogram** and lack of vasculopathy/ASCVD
Fibromuscular Dysplasia: 
String of Beads

Diagnosis: Arteriogram
Renal Arteriograms for the Boards

- Stenosis alternating with aneurysm
- PAN: medium vessels Branch points
- Fibromuscular Dysplasia: String of Beads
- Takayasu’s Arteritis
Fibromuscular Dysplasia
(Non-inflammatory, non-atherosclerotic angiopathy)

• Pathology
  • Vessel: Fibromuscular thickening that may involve the intima, media* or adventitia.
  • Kidney: diffuse ischemic atrophy (glomeruli, tubules and interstitial fibrosis).
Renovascular Disorders (key derivative topics)

- Malignant HTN (physiology, pathology, pharmacology)
- Arteriolosclerosis $\rightarrow$ Nephrosclerosis (pathology)
- Renal Artery Stenosis (physiology and consequences)
  - Fibromuscular Dysplasia (diagnostics, pathology)
  - *Takayasu’s Arteritis* (pathology)
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