Renal Artery Disease

Robert D. McBane, M.D.
Division of Cardiology
Mayo Clinic Rochester

Financial Disclosure Information
Renal Artery Disease
Robert McBane, MD

None

Learning objectives:
Renal Artery Disease

To appreciate:
1. Which patients with hypertension require screening for renal artery stenosis
2. Which patients with renal artery stenosis require an intervention
3. Proper evaluation and management of renal fibromuscular disease.

SCREENING

54 y/o male
He has a 10 year history of hypertension. He is a non-smoker. He takes chlorthalidone 25 mg/day (like his father). Renal function is normal.
Exam: BP 160/90 Pulse 80 regular
Cor: normal JVP, PMI. No M/R/C/G
Abdomen: No HSM or bruits
What would you recommend for this patient?
1. Renal Duplex ultrasound
2. CTA renal arteries
3. MRA renal arteries
4. Plasma renin activity
5. Augment chlorthalidone

http://www.cdc.gov/bloodpressure/facts.htm
Societal Cost of Hypertension

~$50 Billion each year

http://www.cdc.gov/bloodpressure/facts.htm

“Primary” Hypertension

90-95% of all hypertension
- Family history
- African American
- Excess Na+ intake
- Excess alcohol intake
- Obesity
- Inactivity

Who should be evaluated for secondary causes?

- **Severe** or **resistant** hypertension
- **Acute onset**
- Onset before **puberty**
- Onset ≤ 30 yrs old, **no family history** or obesity
- Search for **clinical clues**

Renovascular Hypertension

Clues:
- Diffuse atherosclerosis
- 50% rise in creatinine with ACE-I or ARB
- Renal atrophy (>1.5 cm)
- Flash pulmonary edema
- Severe htn onset > 55 yrs
- Abdominal bruit

Renovascular Hypertension:

Prevalence
- By hypertension severity
  - Mild – mod: <1%
  - Severe: 30 – 45%
- Coexisting cardiovascular disease
  - CAD 20%
  - PAD 50%
  - CHF 50%
  - ESRD 50%

Limit testing to those **likely to benefit** from an intervention
- Short duration of hypertension
- Failure of optimal treatment
- Medication intolerant
- Progressive CKD
- FMD (particularly young female)
- Recurrent flash pulmonary edema

Am J Hypertens 2010;23:1159
J Vasc Surg 2002;36:443
J Hypertens 2009;27:1333
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Duplex Ultrasound

Advantages
• Widely available
• No contrast or radiation
• Trials: > 90% sens/spec

Limitations
• Obesity
• Technically difficult
• Time intensive (~ 2 hours)
• Real world: 60% sens/spec
  20% technically inadequate

Renal US: Resistive Index

• Measure of parenchymal fibrosis
• Segmental arteries
• RI = (PSV-EDV)/PSV
• Values > 80
  • Intrinsic kidney disease
  • Poor outcomes from interventions

CT Angiography

Advantages
• Widely available
• Beautiful pictures
• Trials: > 90% sens/spec

Limitations
• No intervention possible
• Radiation exposure
• Contrast nephropathy

MR Angiography

Advantages
• Widely available
• Beautiful pictures
• No radiation
• Trials: > 90% sens/spec

Limitations
• No intervention possible
• Nephrogenic systemic fibrosis

Renal artery disease: Screening

• Only if a corrective procedure will be pursued if disease detected
54 y/o male
He has a 5 year history of hypertension. He uses moderate daily alcohol. Sedentary. He takes chlorthalidone 50 mg, amlodipine 2.5 mg, metoprolol 50 mg/BID (like his father).
Exam: Wt 120 kg Ht 170 cm
BP 160/90 Pulse 50 regular
Cor: normal JVP. S4 at apex
Abdomen: bruit on left
Creatinine is 1.5.

When counselling this patient, which of the following statements is true regarding PTRA/stenting of his left renal artery?

1. Renal artery stenosis is the most likely cause of his hypertension
2. PTRA/stenting is likely to improve his BP
3. PTRA/stenting is likely to preserve renal function
4. Renal artery stenosis is an independent predictor of MI and CV mortality
5. PTRA/stenting is likely to improve CV outcomes

Resistant Hypertension

• Definition
  • Not controlled by ≥ 3 BP meds
• Associations
  • Obesity
  • Increasing age
  • Poor compliance (meds or diet)
  • “Secondary” hypertension
  • “White coat” hypertension
Resistant Hypertension Causes

- Excess salt
- Medication
  - Inadequate doses
  - Inadequate diuretic
  - Drugs (e.g., NSAIDs, illicit drugs, sympathomimetics, OCPs)
- Excess alcohol intake

Obstructive Sleep Apnea

Clues:
- Nocturnal choking/gasping
- Daytime somnolence
- Inappropriate sleep

Screen:
- Overnight oximetry
- Polysomnography

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Exam:
- Wt 120 kg  Ht 170 cm
- BP 160/90  Pulse 50 regular
- Cor: normal JVP. S4 at apex
- Abdomen: bruit on left

Creatinine is 1.5.

Renovascular Hypertension

- Most common potentially correctable cause
- <1% of mild hypertension
- 10-40% of patients with severe hypertension
- Strong mortality predictor
  - 16%/year
  - 2-4x elevated risk of MI

Renovascular Hypertension

Progression to ESRD, “Ischemic nephropathy”

- Rare with FMD
- Rare with unilateral disease
- More likely if bilateral or solitary kidney
- Difficult to predict which patients will progress

ASTRAL Trial

Subjects: Refractory htn, renal dysfx, Athero RAS

- PTRA with stent (95%)
- Medical therapy

Primary outcome: Change in renal function

NEJM 2009;361:1953
**NO Change in renal function**

Reciprocal Serum Creatinine

Serum Creatinine

NEJM 2009;361:1953

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**CORAL Trial**

Subjects: Refractory htn (≥ 2 meds), CKD, Athero RAS

PTRA with stent (95%)

947 patients

Medical therapy

Primary outcome: CV or renal death, MI, stroke, CHF, worsening CKD or renal-replacement therapy


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**CORAL Found No Difference**

Primary outcome: MACE or Renal Event

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**STAR Trial**

Subjects: CKD, ostial RAS, and stable BP

PTRA with stent (72%)

140 patients

Medical therapy

Primary outcome: Change in renal function


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**STAR Found No Difference**

Primary outcome: Worsening renal function

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**Trial** | **N** | **No Difference**
--- | --- | ---
ASTRAL | 806 | Renal preservation
Blood pressure
Renal events
CV events
Overall survival

Coral | 947 | MACE or Renal events
Medication requirements
Overall survival

STAR | 140 | Renal preservation
Blood pressure
Overall survival

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N=140 patients

Renal artery stenosis

- Know the **clinical clues** to its presence
- Recognize the association with **ischemic cardiovascular disease**
- Recognize that patients may have **incidental RAS** (< 70% stenosis) which may not be the cause of hypertension
- **Only if the clinical scenario is compelling**
  (severe stenosis, severe resistant HTN, recurrent flash pulmonary edema, declining GFR/atrophy), then stenting may be indicated.

When considering Treatment Renovascular Hypertension

- Antihypertensive drugs are effective
- Correcting the stenosis may not improve outcomes
- No tools to predict who will benefit
- Don’t forget to treat other risk factors
  - Tobacco
  - Lipids
  - DM

30 y/o female

Notes intermittent forceful palpitations for 2 months. She is an RN. Recent serial BPs: 168/96 & 186/102. Five months ago, her GYN evaluation included a normal BP assessment. She is very active. No tobacco, minimal alcohol. Otherwise healthy.

Exam: Wt 52 kg  Ht 162 cm
BP 138/102  Pulse 70 regular
Cor: normal JVP. Subtle S4 at apex
Abdomen: bruit subxyphoid

Creatinine is 1.1. GFR 56

When counselling this patient, which of the following would you recommend?
1. Balloon angioplasty
2. Balloon angioplasty with bare metal stent
3. Balloon angioplasty with drug eluding stent
4. Renal artery Bypass
5. Treat medically: ARB or ACE I.
Hypertension: “Cured”

- Bilateral perimedial fibroplasia
- Pre PTA 180/110
- Post PTA 122/78

Drugs to Avoid During Pregnancy

- **ACE I, ARB**
  - Renal (late trimester)
  - Cardiac (early trimester)
- Diuretics
- Nitroprusside
  - Fetal cyanide poisoning

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3. Balloon angioplasty with drug eluding stent
4. Renal artery Bypass
5. Treat medically: ARB or ACE I.

But, what if this was the angiogram?

What is your Diagnosis?

1. Atherosclerosis
2. Variant FMD
3. Vasculitis
4. Neurofibromatosis
5. Vasospasm: Ergotamine/Cocaine
What is your Diagnosis?
1. Atherosclerosis
2. **Variant FMD**
3. Vasculitis
4. Neurofibromatosis
5. Vasospasm:
   - Ergotamine/Cocaine

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**McCormick Classification**

- **Medial Fibroplasia**: 90%
  - Distal 2/3rds of artery
  - "String of beads"

- **Intimal Fibroplasia**: 5%
  - Long smooth tubular stenosis

- **Perimedial Fibroplasia**
  - Beads "smaller than normal artery"

- **Medial Hyperplasia**
- **Adventitial Fibroplasia**

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**US FMD Registry**

- **9 Centers**
- **447 patients**

  - Age @ first symptom: 47 ± 15 years
  - Age @ diagnosis: 52 ± 13 years
  - Females: 91%
  - Race:
    - Caucasian: 95%
    - Black: 2%
    - Hispanic: 2%

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**Distribution of Vascular Involvement**

- Renal artery: 80%
- Extracranial Carotid: 74%
  - Intracranial carotid: 17%
  - Intracranial aneurysm: 8%
- Vertebral: 37%
- Mesenteric: 26%
- Lower extremity: 60%
- Upper extremity: 16%

*Multivessel involvement 35%
**Medial fibroplasia 91%*
### Aneurysms

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<th>Overall</th>
<th>76 (17%)</th>
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<td>Renal</td>
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<tr>
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<td>Aorta</td>
<td>15</td>
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</table>

> 1 vessel 17%

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### Takayasu Arteritis

- **Women of reproductive years** 15 - 50 yrs

#### Stenoses
- Subclavian
- Common carotid
- Aorta
- Renal

#### Aneurysms
- Aorta
- Innominate
- Subclavian

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### 28 y/o female

Fatigue, anemia, left arm and leg weakness. She works as an X-ray technician. Her anemia was attributed to "chronic disease". Her physical therapist could not detect a pulse in her left arm.

Exam:
- BP (right) 162/70 (left) not obtainable
- Chest: multiple bruits
- Cor: S4
- Abdomen: bruit centrally

Hbg 10.8  ESR 61

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### Takayasu Arteritis

#### Hypertension
- High renin
- Often unrecognized
- Common cause of death
### Renal Artery Occlusive Disease: Potential Causes

- Atherosclerosis
- FMD
- Aneurysm
- AV fistula
- Trauma
- Coarctation
- Vasculitis
- Embolism

### Renal Artery Stenosis: Summary

- Hypertension is common
- Antihypertensive drugs are effective
- Secondary causes require searching for clinical clues
- Assessment includes a careful pre-test probability of disease evaluation
- Selecting patients for renal artery interventions should be done carefully