Review and Update on the Evaluation of Hypertension in the Young Adult

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Review and Update on the Evaluation of Hypertension in the Young Adult

Top 10 reasons for spending the next 89 minutes at this talk on HTN:
Top 10 reasons for spending the next 89 minutes at this talk on HTN:

10. >74 million have HTN (33% of US population)
    #1 Primary diagnosis
Top 10 reasons for spending the next 89 minutes at this talk on HTN:

9. Another 70 million have pre-HTN
Top 10 reasons for spending the next 89 minutes at this talk on HTN:

8. 
Prevalence is expected to increase due to aging population and overweight/obesity
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Top 10 reasons for spending the next 89 minutes at this talk on HTN:

7. 90% lifetime risk of developing HTN
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Top 10 reasons for spending the next 89 minutes at this talk on HTN:

6. Major risk for CHF, Stroke, MI, and Renal failure
Top 10 reasons for spending the next 89 minutes at this talk on HTN:

5. CVD risk doubles for each 20/10mmHg increase above 115/75mmHg
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Top 10 reasons for spending the next 89 minutes at this talk on HTN:

4. Control of BP reduces Morbidity & Mortality from CHF (50%), stroke (40%), MI (25%)
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Top 10 reasons for spending the next 89 minutes at this talk on HTN:

3. Pre-HTN: lifestyle modifications prevent progressive BP rise and CVD
Top 10 reasons for spending the next 89 minutes at this talk on HTN:

2. Working with the college health population gives us the opportunity to have a significant impact on the prevention and treatment of this common health problem
Top 10 reasons for spending the next 89 minutes at this talk on HTN:

1. It is too late! You are already here and it would be really embarrassing to leave now.
Clinical History

Clinical Presentation

- 19 y o man, new patient, on the row team, presents with a c/o nasal congestion, sore throat and cough, for 3 days
  - Denies fever, or other complaints, has taken OTC cold preps but still feels bad
  - Was up most of the night cramming, needs to get better today, has a midterm tomorrow and a rowing competition this weekend; He was advised by his coach to come in for an antibiotic prescription

- In triage his BP was noted to be 170/110

Medications:

- OTC Dayquil
- Adderall 10 mg twice daily

Allergy: None
HTN: Clinical Case 1
Clinical History

- Past Medical History
  - ADD
  - No medical problems, surgery or hospitalization

- Family History
  - Mother: HTN
  - No early CAD or sudden death

- Social History
  - ETOH: 8 drinks a week; >5 drinks/day 2X a month
  - Recreational Drugs: None
  - Tobacco: None

- Review of System
  - No headache, nausea, vomiting, diaphoresis
  - No confusion, dizziness, blurry vision, paresthesia, weakness, stiff neck
  - No chest pain, palpitations, dyspnea, wheezing, PND, exercise intolerance
  - No polydipsia, polyuria
  - No rash
HTN: Clinical Case 1
Physical Examination

- **Vital Signs**
  - Alert, oriented, no distress; just finishing a 20 oz coffee
  - BP average of 3 after resting
    - BP 170/110 R arm
    - BP 168/108 L arm
  - P 90 reg., T 99, R 12
  - Height 5’11”, Weight 150 lbs.
  - Normal BMI

- **HEENT**
  - Throat: Mild erythema, no exudate, no tonsillar enlargement
  - Fundi: no exudates, papilledema
  - No cervical adenopathy, palpable thyroid or bruit

- **Heart:**
  - RRR; No murmur, rubs

- **Lungs:**
  - Clear

- **Abdomen:**
  - No tenderness, organomegaly, bruits

- **Extremities:**
  - Pulses full, symmetrical and no delays
  - No edema

- **Neuro:**
  - CN intact, Motor 5/5, Sensory intact, Reflexes 2+
You advise him on URI self care, to stop the pseudoephedrine, hold the Adderall and taper off the caffeine.

You counsel him on lifestyle modification. In addition which of the following is the most reasonable:

A) Prescribe a Z-Pac and follow up on Monday after he returns from the competition.
B) Follow up for a BP check within 3 days; no strenuous exertion in the mean time.
C) Start Thiazide Diuretic and follow up within 3 days; no strenuous exertion in the mean time.
D) Start Thiazide Diuretic and ACE Inhibitor and follow up within 3 days; no strenuous exertion in the mean time.
E) Refer to ER for immediate evaluation and management of his HTN
HTN: Clinical Case 1
Follow-up

- On follow up visits, after stopping decongestants, caffeine and Adderall, his BP remains persistently elevated, 154/96

- Routine laboratory testing:
  - CBC normal
  - FBS 88 mg/dl
  - Hgb A1C 5.2%
  - Sodium 141 mg/dl
  - K 3.3 mg/dl (low)
  - HCO3 32 meq/dL (high)
  - BUN 19 mg/dl
  - Cr 0.7 mg/dl
  - Calcium 10 mg/dL
  - TSH 3.2 mIU/L
  - UA normal
  - Spot ur normal

- ECG normal no LVH
In addition to starting HTN medication, what further testing should be done?

- **A)** No need for further work-up
  - It’s primary HTN
- **B)** Renal doppler
  - R/O fibromuscular displasia
- **C)** Renal sonogram
  - R/O renal parenchymal disease
- **D)** Plasma renin activity and aldosterone
  - R/O primary hyperaldosteronism
- **E)** 24-hour urine for metanephrines
  - R/O pheochromocytoma
HTN: Clinical Case 1
Follow-up

• BP is now controlled 130/82 on medication.
• Patient needs clearance to return to rowing competition.
• You advise which of the following:
  • A) No further work-up, he can resume full activity without restriction
  • B) He needs an Echocardiogram; if normal, he can resume full activity without restriction
  • C) He should NOT resume any high intensity activity including rowing
20 y.o. woman for a 3-month follow-up after starting an estrogen/progestin OCP

- **BP** is now **156/96** (baseline **BP132/84**)
- **BMI** is now **26** (baseline **24**)

You advise her on lifestyle modification including weight loss and repeat BP check in one month.

In addition, which of the following would be the most reasonable:

- A) Continue the current pill
- B) Continue current pill and start **amlodipine 5 mg daily**
- C) Change to a progestin only pill
- D) Stop the pill and advise other **non-hormonal birth control**
HTN: Clinical Case 2

• She followed-up with her PMD
  • BP was persistently elevated despite stopping the OCP
  • She was started on Lisinopril 5 mg daily

• She comes for follow-up at the Health Services for missed menstrual period
  • HCG test is positive (estimate 7 weeks pregnant)
  • BP is 140/90 on Lisinopril

• What is the next best step?
  • A) Continue Lisinopril, recheck BP in 2 weeks
  • B) Stop Lisinopril and start Amlodipine 5 mg daily, recheck BP in 2 weeks
  • C) Stop Lisinopril and start Methyldopa 250 mg BID, recheck BP in 2 weeks
  • D) Stop Lisinopril and recheck BP in 2 weeks
Outline

I. Definition/Diagnosis
II. CV Risk Assessment
III. Evaluation
IV. Secondary Hypertension
V. Management
IV. Special Populations
I. HTN Definition/Diagnosis
• Blood pressure
  • One of the most important measurements in all of clinical medicine
  • One of the most inaccurately performed
HTN Diagnosis: BP Measurement

- Patient preparation:
  - Comfortably seated in a chair
  - Legs uncrossed with the back and arm supported
  - Remove clothing that covers location of cuff
  - Middle of cuff on the upper arm placed at level of R atrium (mid-point of sternum)
  - Initial visit: BP both arms
  - Patient (and Provider) should relax and not talk
  - Wait 5 minutes before the first reading is taken
HTN Diagnosis: Definitions

- Primary HTN (formerly essential or idiopathic)
  - Neither a secondary nor monogenetic cause
  - 90% of all HTN cases
- Secondary HTN
  - Identifiable and potentially curable condition
- Spurious HTN (pseudo-HTN)
  - Artifactual elevation reading
  - Stiff, calcified brachial artery
- White Coat HTN
  - Office BP >140/90
  - Daytime ambulatory or self-home BP <135/85
- Masked HTN
  - Office BP norml
  - Self-home BP elevated
HTN Diagnosis: Definitions

- **Refractory/Resistant HTN**
  - BP >140/90 despite:
    - 3 drugs of different classes
    - At maximal doses
    - 1 month to take effect

- **Hypertensive Crisis**
  - **Hypertensive Urgency**
    - DBP >120 mmHg with NO acute or rapidly advancing TOD
  - **Hypertensive Emergency**
    - Acute or worsening TOD associated with elevated BP but irrespective of level of BP

- **Accelerated HTN**
  - Hypertensive emergency with retinal hemorrhage and exudates

- **Malignant HTN**
  - Hypertensive emergency with papilledema
HTN Diagnosis: Definitions

- HTN based on **Office** readings
  - Systolic BP \( >140 \) or Diastolic \( >90 \)
  - 2 or more readings on each of \( >2 \) visits; 1-2 weeks apart
  - Age \( >18 \), not acutely ill

- HTN based on **Self-Home** readings
  - Home average \( >135/85 \)

- HTN based on **Ambulatory 24-hour** readings
  - Daytime (awake) average above \( >135/85 \)
  - Nighttime (asleep) average above \( >125/75 \)
  - 24-hour average \( >130/80 \)
HTN Diagnosis: Classification

- **JNC 7 (2003)**
  - Normal:
    - < 120/80
  - Pre-hypertension:
    - 120-139/80-89
  - Hypertension
    - Stage 1: 140-159/90-99
    - Stage 2: ≥ 160/100

*2 or more readings on each of >2 or more visits; 1-2 weeks apart

- **European Societies of HTN and Cardiology (2007)**
  - Normal:
    - Optimal: < 120/80
    - Normal: 120-129/80-84
    - High normal: 130-139/85-89
  - Hypertension:
    - Grade 1: 140-159/90-99
    - Grade 2: 160-179/100-109
    - Grade 3: ≥ 180/110
  - Isolated Systolic HTN
    - SBP ≥140 and
    - DBP < 90
HTN Diagnosis:
Home BP Monitoring (HBPM)

• Benefits (vs Office readings)
  • Correlate better with TOD and CV events
  • Office BP is variable, only measured q 3-6 months
  • Better compliance with medication

• Measurement
  • Patient is seated and resting for at least 3-5 minutes
  • Use upper arm at heart level
  • 2 BP measurements, 1 minute apart
  • BP is recorded twice daily, ideally in AM and PM
  • Continue for at least 4 days, ideally for 7 days
  • Discard BP measurements taken on the first day
  • Average all remaining measurements [new 2011]
  • HTN: Home average >135/85

• Automated home devices that have memory or printouts of the readings are recommended
HTN Diagnosis: Ambulatory BP Monitoring (ABPM)
HTN Diagnosis: Ambulatory BP Monitoring (ABPM)

• Indications:
  • Suspect White-coat HTN
  • Suspect Episodic HTN
  • HTN resistant to medication
  • Hypotensive symptoms while on HTN medications

• Measurement:
  • Usual waking hours (for example, 08:00 - 22:00)
    • 2-3 measurements per hour
    • Average daytime BP
  • Usual nighttime hours
    • 1-2 measurements per hour
    • Average nighttime BP
## HTN Diagnosis: BP Monitoring

<table>
<thead>
<tr>
<th></th>
<th>Office</th>
<th>Ambulatory 24-hour</th>
<th>Self-Home</th>
</tr>
</thead>
<tbody>
<tr>
<td>Predicts events</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Diagnostic utility</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Detects white coat and masked HTN</td>
<td>No</td>
<td>Yes</td>
<td>Yes (limited)</td>
</tr>
<tr>
<td>Evaluates the circadian rhythm of BP</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Evaluation of therapy</td>
<td>Yes</td>
<td>Yes (limited repeat uses)</td>
<td>Yes</td>
</tr>
<tr>
<td>Normal limit for average risk patients (mm Hg)</td>
<td>140/90</td>
<td>125/75 (sleep)</td>
<td>135/85</td>
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<tr>
<td></td>
<td></td>
<td>135/85 (awake)</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>130/80 (24-hour)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>135/85</td>
<td></td>
</tr>
<tr>
<td>Cost</td>
<td>Low</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Reimbursement</td>
<td>Yes</td>
<td>Partial</td>
<td>No</td>
</tr>
</tbody>
</table>
HTN Diagnosis: BP Monitoring

• Follow-up after initial BP (without TOD or CV Risk):
  • **Normal:**
    • Recheck in 2 years
  • **Pre-HTN:**
    • Recheck in 1 year
  • **Stage 1 HTN:**
    • Confirm within 2 months
  • **Stage 2 HTN:**
    • Evaluate within 1 month
    • For BP >180/110, evaluate immediately or within 1 week depending on clinical situation and complications
II. HTN AND CV RISK
HTN and CV Risk:

- Direct relationship between BP and CV disease and vascular mortality
- CV mortality increased progressively throughout the range of BP starting at 115/75
- ≈15% of BP-related deaths from CHD occur with BP in the pre-HTN range
HTN and CV Risk: Risk Factors

• Major Risk Factors for CVD
  • Hypertension
  • Age
    • >55 years for men; >65 years for women
  • Diabetes mellitus
  • Elevated LDL (or total) cholesterol or low HDL cholesterol
  • Estimated GFR <60 mL/min
  • Family history of premature CVD
    • <55 years for male relatives; <65 years for female relative
  • Micro-albuminuria
  • Obesity (BMI >30 kg/m2)
  • Physical inactivity
  • Tobacco usage, particularly cigarettes
HTN and CV Risk: TOD

- **Target Organ Damage**
  - **Heart**
    - LVH
    - Angina/prior MI
    - Prior coronary revascularization
    - Heart failure
  - **Brain**
    - Stroke or transient ischemic attack
    - Dementia
  - **CKD**
  - **Peripheral arterial disease**
  - **Retinopathy**
HTN and CV Risk
Normal Retina
HTN and CV Risk: TOD Retinopathy

- **Mild**
  - Arteriolar narrowing related to vasospasm
  - Arteriolar wall thickening or opacification
  - Arteriovenous nicking, referred to as nipping
HTN and CV Risk: TOD Retinopathy

• **Moderate**
  - Hemorrhages, either flame or dot-shaped, cotton-wool spots, hard exudates, and microaneurysms

• **Severe**
  - Some or all of the above, plus optic disc edema.
  - The presence of papilledema mandates rapid lowering of the BP
III. HTN EVALUATION
HTN Evaluation: Goals

• Goals
  • Guide work up of secondary HTN
  • Assess presence or absence of TOD/CVD
  • Assess identify and manage CV risk factors
  • Identify comorbid conditions that may effect choice of treatment/drug interactions

• Patient Evaluation
  • History
  • Physical examination
  • Laboratory testing
  • Other procedures
HTN Evaluation:
History

• Past History of HTN
  • Duration and severity of HTN
  • Pregnancy-related HTN
  • Prior work up
  • Previous treatments: efficacy/side effects

• Past History
  • CV Risk: DM, CAD, Stroke, PVD, Renal disease, Lipid disorder
  • Others: Gout, Asthma, Depression, Sexual dysfunction

• Medications/Supplements
  • OC, NSAIDS, Steroids
  • Caffeine, Adderall/Sympathomimetics, Decongestants

• Family History
  • HTN, Premature CVD, Lipid disorder, DM

• Social History
  • Smoking, Alcohol, Cocaine/amphetamines, Exercise/sedentary, Salt intake

• Review of System
HTN Evaluation: Physical Exam

- **Vital Signs**
  - Appropriate BP measurement in both arms
  - Ht/Wt/BMI/waist circumference

- **HEENT**
  - Optic fundi, carotid bruits, thyroid gland

- **Heart**
  - Heart size, murmur

- **Lungs**

- **Abdomen**
  - Abdominal masses (e.g. enlarged kidneys), distended urinary bladder, abnormal aortic pulsation and bruit

- **Extremities**
  - BP lower extremity
  - Edema, pulses, femoral bruit

- **Neurological**
HTN Evaluation: Laboratory

- Initial Laboratory Testing
  - CBC
  - Fasting Blood Glucose, HgA1c
  - Sodium, Potassium, BUN, Creatinine, GFR, Calcium
  - Lipid profile (9-12 hr. fast) including HDL, LDL, TGL
  - UA With Microscopic Exam
  - Spot Urine for Albumin/Creatinine Ratio
  - 12-lead ECG

- More testing for identifiable causes indicated if:
  - History, Physical exam or Laboratory tests suggest secondary cause
  - BP control not achieved
IV. SECONDARY HTN
Secondary HTN:

• Secondary HTN
  • Potentially curable disorder
  • Accounts for about 10% of all cases of HTN

• Clinical clues:
  • Onset prior to puberty
  • Onset <30 in non-obese, without family history of HTN, or other risk factor for HTN
  • Onset >60yo
  • Onset is sudden
  • BP begins to increase for uncertain reason after being well controlled
  • Severe (BP > 180/120) or resistant HTN
Secondary HTN: Causes

• Renal
  • Renal Vascular Disease
    • Fibromuscular dysplasia
    • Atherosclerotic Renal artery stenosis
  • Renal Parenchymal Disease
    • Acute Glomerulonephritis
    • Diabetic Nephropathy
    • Polycystic Disease
    • Chronic Nephritis
    • Hydronephrosis
• Collagen Vascular Disease
• Renin Secreting Tumors
Secondary HTN: Causes

- **Endocrine**
  - **Thyroid**
    - Hyperthyroidism
    - Hypothyroidism
  - **Adrenal**
    - Mineralocorticoids overproduction
      - Primary Aldosteronism
      - Congenital Adrenal Hyperplasia
    - Catecholamine overproduction
      - Pheochromocytoma
    - Glucocorticod overproduction
      - Cushing Syndrome
  - **Hyperparathyroidism**
  - Acromegaly
  - **Vitamin D deficiency**
Secondary HTN: Causes

- Miscellaneous
  - Sleep Apnea
  - Pregnancy induced HTN
  - Coarctation of the Aorta
  - Postoperative HTN
- Neurologic Disorders
  - Dysautonomia
  - Increased Intracranial Pressure
  - Quadriplegia
  - Lead poisoning
  - Gullian-Barre Syndrome
Secondary HTN: Causes

- Isolated SBP HTN
  - Aging with aortic rigidity
  - Increased cardiac output
    - Thyrotoxicosis
    - Anemia
    - Aortic Valvular Insufficiency
  - Decreased peripheral vascular resistance
    - AV Shunts
    - Paget Disease of Bone
    - Beriberi
### Secondary HTN: Causes*

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Age</th>
<th>% Secondary</th>
<th>Etiology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Children</td>
<td>0-12yo</td>
<td>70-85%</td>
<td>Renal parenchymal disease Coartation of the aorta</td>
</tr>
<tr>
<td>Adolescents</td>
<td>12-18</td>
<td>10-15%</td>
<td>Renal parenchymal disease Coartation of the aorta</td>
</tr>
<tr>
<td>Young Adults</td>
<td>19-39</td>
<td>5%</td>
<td>Thyroid dysfunction Fibromuscular disease Renal parenchymal disease</td>
</tr>
<tr>
<td>Middle-aged Adults</td>
<td>40-64</td>
<td>8-12%</td>
<td>Aldosteronism Thyroid dysfunction Obstructive sleep apnea Cushing syndrome Pheochromocytoma</td>
</tr>
<tr>
<td>Older adults</td>
<td>&gt;65</td>
<td>17%</td>
<td>Atherosclerotic renal artery stenosis Renal failure Hypothyroidism</td>
</tr>
</tbody>
</table>

* Excluding obesity, dietary and drug causes
### Secondary HTN: Causes

<table>
<thead>
<tr>
<th>Class</th>
<th>Drugs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcohol</td>
<td>Ethanol</td>
</tr>
<tr>
<td>Estrogen</td>
<td>Oral contraceptives</td>
</tr>
<tr>
<td>Sympathomimetic</td>
<td>Decongestants, diet pills, Adderall</td>
</tr>
<tr>
<td>Herbal</td>
<td>Ephedra, ginseng, ma huang</td>
</tr>
<tr>
<td>Illicit</td>
<td>Amphetamines, cocaine</td>
</tr>
<tr>
<td>NSAID</td>
<td>Cyclooxygenase-2 inhibitors, ibuprofen, naproxen (Naprosyn)</td>
</tr>
<tr>
<td>Psychiatric</td>
<td>Buspirone, bupropion, carbamazepine, clozapine, fluoxetine, lithium,</td>
</tr>
<tr>
<td></td>
<td>tricyclic antidepressants</td>
</tr>
<tr>
<td>Steroid</td>
<td>Methylprednisolone (Depo-Medrol), prednisone</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>Erythropoietin, cyclosporin</td>
</tr>
</tbody>
</table>
Secondary HTN: Renal Parenchymal Disease

• Renal parenchymal disease
  • Most common cause of HTN in preadolescent children
  • Renal pathology
    • Glomerulonephritis
    • Congenital abnormalities
    • Reflux nephropathy

• When to suspect?
  • Palpable enlarged kidneys
  • Increased BUN, creatinine
  • Abnormal UA sediments (e.g. RBC, casts)

• Screening
  • Renal ultrasound
Secondary HTN: Thyroid Disease

- **Thyroid disease**
  - Common in young adults
  - Hormone affects cardiac output and systemic vascular resistance
  - **Hypothyroidism**
    - Elevation in diastolic BP
  - **Hyperthyroidism**
    - Isolated elevation of systolic BP
    - Widened pulse pressure

- **When to suspect?**
  - **Clinical:**
    - Bradycardia/tachycardia
    - Cold/heat intolerance
    - Constipation/diarrhea
    - Irregular, heavy, or absent menstrual cycle
  - **Abnormal thyroid function tests**
Secondary HTN: Renovascular Disease

• Etiologies
  • **Fibromuscular dysplasia**
    • Angiopathy affecting medium-sized arteries
      • Renal 60-75%, Cerebrovascular 25-30%, Visceral 9%, Peripheral 5%
      • Multiple regions 26%
    • Predominantly in young women
    • Can cause refractory renovascular HTN
  • **Atherosclerosis**
    • Most common cause in older patients
Secondary HTN: Renovascular Disease

• When to suspect?
  • Onset <age 30 or >50 (esp. w/o FH of HTN)
  • Accelerated HTN, grade 3 or 4 retinopathy
  • HTN well controlled now resistant
  • Abdominal bruit esp. with diastolic component, with radiation to one or both flanks
  • Recurrent flash pulmonary edema
  • Renal failure esp. w/o proteinuria or abnormal urine sediment
  • Starting ACEI or ARB: >30% increase in creatinine over baseline or acute renal failure
  • Paradoxical worsening of HTN with diuretic use
Secondary HTN: Renovascular Disease

• **Work-up**
  - **Noninvasive screening tests include:**
    - Magnetic resonance angiography
    - CT scan
    - Duplex Doppler flow studies
    - ACEI-enhanced renal scan
  - **Renal artery angiography**
    - Gold standard but it is not recommend for diagnosis due to risk of procedure

• **Treatment:**
  - Mostly angioplasty/stenting for FMD
  - Mostly medical for atherosclerosis
Secondary HTN: Primary Aldosteronism

- **Primary aldosteronism**
  - 10-14% of undetected HTN cases
    - Most prevalent among middle-aged adults
  - Excess mineralocorticoid (aldosterone) production by the adrenal gland
    - Associated plasma renin activity suppression
  - Most common etiology
    - Aldosterone-producing adrenal adenoma
    - Idiopathic hyperaldosteronism/bilateral adrenal hyperplasia

- **When to suspect?**
  - Severe or resistant HTN
  - Serum $K < 3.5$ mEq/L
  - Serum $K < 3.0$ mEq/L on diuretic
    - Hypokalemia is not a universal finding
  - Metabolic alkalosis
Secondary HTN: Primary Aldosteronism

• **Screening**
  - **Plasma aldosterone (PA)/Plasma renin activity (PRA) ratio**
    - Ratio >20 with a PA of 15 ng/dL suggestive
    - Ratio >70 with a PA of >15 ng/dL and a PRA < 1ng/ml/hr is virtually diagnostic

• **Work-up**
  - **High-resolution adrenal CT**
    - Distinguish aldosterone-producing adenoma vs. Idiopathic hyperaldosteronism

• **Management**
  - **Surgical**
  - Spironolactone or other mineralocorticoid antagonist is the treatment of choice
Secondary HTN: Coarctation of the Aorta

- **General**
  - **Constriction of the aorta**
    - Usually thoracic and distal to origin of L subclavian artery
  - **Prevalence: 1 in 10,000 live births**
    - 5-8% of all congenital heart disease
  - **ACE/ARB may have adverse effects if used for HTN control prior to repair**

- **Symptoms:**
  - Usually none
  - Cold feet, claudication, exercise intolerance, CP, HA

- **Physical exam:**
  - **BP in upper extremities > leg BP: >20 mmHg**
  - Diminished delayed femoral pulses
  - **To-fro machinery murmur**
    - Left infraclavicular area and under the left scapula
  - **Ejection click and murmur may be audible (bicuspid aortic valve)**
Secondary HTN: Coarctation of the Aorta

- **Work-up:**
  - Cardiac MRI
  - Cardiac CT angiography
  - Doppler Echocardiography

- **Management:**
  - Surgical repair
  - Annual evaluation for HTN and re-coarctation, aortic aneurysm and valvular disease (e.g. cardiac MRI)
Secondary HTN: Obstructive Sleep Apnea

- Obstructive sleep apnea
  - 50% of patients with sleep apnea have HTN
  - 30% of patients with HTN have sleep apnea
  - HTN and sleep apnea
    - Causal relationship not clear
    - May simply share risk factors

- Proposed etiologies
  - Apnea induced hypoxia causing increased sympathetic stimulation resulting in:
    - Increased peripheral resistance
    - Increased and cardiac output
  - Sleep deprivation alone
Secondary HTN: Obstructive Sleep Apnea

• When to suspect?
  • Snoring, typically in obese male
  • Sleep fragmentation
  • Daytime hypersomnolence, fatigue
  • Headaches (especially AM)
  • Cognitive impairment
  • Apnea induced hypoxia

• Work-up
  • Overnight polysomnography

• Treatment:
  • Weight loss
  • Cessation of alcohol and sedatives
  • Avoiding supine position for sleep
  • Nocturnal C-pap
Secondary HTN: Pheochromocytoma

• **Pheochromocytoma**
  - Rare disorder <0.2%
  - Catecholamine-secreting tumor in the adrenal medulla and sympathetic ganglia

• **When to suspect**
  - Labile HTN often superimposed on baseline HTN
  - Paroxysms of HTN with pounding headache, palpitations, perspiration and pallor
  - Orthostatic hypotension
  - Drug-resistant HTN
  - History of adrenal incidentaloma
Secondary HTN: Pheochromocytoma

- **Screening**
  - 24-hour urine free metanephrines
    - Specificity 84-98%, sensitivity 97-100%
  - Plasma free metanephrines
    - Specificity 89%, sensitivity 99%

- **Work-up**
  - CT or MRI
  - Adrenal, abdominal and pelvic

- **Surgery**
  - Preoperative treatment of HTN is essential
  - Beta-blockers should be used only after adequate alpha-blockade
**Secondary HTN: Cushing’s Syndrome**

- **Cushings Syndrome**
  - *Excess glucocorticoid states*
    - Exogenous due to chronic steroid therapy (most common)
    - Endogenous (pituitary or adrenal)
- **When to suspect?**
  - Truncal obesity
  - Glucose intolerance
  - Purple striae, Ecchymosis
  - Proximal muscle weakness
  - Drug resistant HTN
  - Incidentaloma
- **Screening:**
  - Dexamethasone suppression test
    - 1mg at 11PM
    - Plasma cortisol at 8AM
V. HTN MANAGEMENT
Questions to be addressed:
  - What are the benefits of treatment?
  - Who should be treated and when?
  - Which therapies should be used?
  - What is the goal BP?
  - How should treatment be monitored?
HTN Management: Benefits of HTN Treatment

• Anti-HTN therapy reduces the risk of CV events in hypertensive individuals
  • Stroke incidence decreased 35-40%
  • Myocardial infarction (MI) decreased 20-25 %
  • HF decreased >50 %
Adoption of healthy lifestyles by all persons is important for the prevention of high BP and those who have HTN.

Combinations of two (or more) lifestyle modifications can achieve synergistic effects:

- Reduce BP
- Prevent or delay the incidence of HTN
- Enhance drug efficacy
- Decrease CV risk
HTN Management: Lifestyle Modifications

- Americans and Lifestyle Risks for HTN
  - Overweight or Obese: 122 million
  - Mean sodium intake (75% from processed foods):
    - 4,100 mg per day for men
    - 2,750 mg per day for women
  - Regular physical activity < 20%
  - > 5 or more fruit and vegetable/day < 25%
# HTN Management: Lifestyle Modifications

<table>
<thead>
<tr>
<th>Modification</th>
<th>Recommendation</th>
<th>SBP Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight reduction</td>
<td>Maintain Normal BMI</td>
<td>5-20 mmHg/10kg</td>
</tr>
<tr>
<td>DASH Diet</td>
<td>Consume fruits, vegetables, low-fat dairy. Reduce saturated and total fat.</td>
<td>8-14 mmHg</td>
</tr>
<tr>
<td>Sodium Restriction</td>
<td>&lt;2.4g Sodium</td>
<td>2-8 mmHg</td>
</tr>
<tr>
<td>Physical Activity</td>
<td>Regular aerobic (at least 30 minutes per day; most days of week)</td>
<td>4-9 mmHg</td>
</tr>
<tr>
<td>Alcohol Moderation</td>
<td>&lt;2 drinks for men</td>
<td>2-4 mmHg</td>
</tr>
<tr>
<td></td>
<td>&lt;1 drink for women; lighter weight men and men &gt;65yo</td>
<td></td>
</tr>
</tbody>
</table>
HTN Management: Lifestyle Modifications

- Smoking cessation
  - Does not lower BP (long-term)
  - Significantly lowers overall CV risk
HTN Management: Pharmacologic Therapy

• Stage 1 HTN without TOD or CV Risk
  • Treat if:
    • BP persistently 140/90-159/99 mmHg
    • 3 to 6 visits
    • Over several months
    • Not controlled with life style modification

• Stage 2 HTN without TOD or CV Risk
  • Offer drug treatment
HTN Management: Pharmacologic Therapy

• Stage 1 or 2 HTN with TOD or CV Risk
  • Treat without delay if with any:
    • Target organ damage (TOD)
    • Established CV disease
    • Renal disease
      • CKD excreting 0.5-1 g protein/day and BP >130/80mmHg [2011]
    • Diabetes
    • 10-year CV risk equivalent >20% [new 2011]
HTN Management: Pharmacologic Therapy

• General concepts
  • 16 classes, 75 different drugs
  • CV risk reduction = BP reduction and not the choice of drug
  • Younger patients
    • ACEI
    • Beta-Blockers (not first-line)
  • Older and possibly African Americans
    • Thiazide diuretics
    • Calcium-channel blockers
  • There may be benefit to giving nighttime dose of medication (not diuretic)
HTN Management: Pharmacologic Therapy

Classification of Anti-HTN Drugs

- Diuretics
  - Thiazide diuretics-7
  - Loop diuretics-3
  - Potassium sparing diuretics-2
- Aldosterone receptor blockers-2
- Beta blockers
  - Beta blockers non-selective-9
  - Beta blockers with intrinsic sympathomimetic activity-3
  - Beta blockers with vasodilator activity-1
  - Combined alpha and beta blockers-2
- ACE inhibitors-10
- Angiotension 2 receptor antagonists-7
- Renin inhibitors-1
- Calcium channel blocker
  - Non-dihydropyridine-5
  - Dihydropyridine-6
- Miscellaneous
  - Alpha1 blockers-3
  - Central alpha-2 blockers and other centrally acting drugs-5
  - Direct vasodilators-2
HTN Management: Pharmacologic Therapy

- HTN: BP <20/10 mmHg over target
  - Life style modification for all
  - Mono-therapy (long-acting)
    - (No contraindication or compelling indication applies)
      - ACEI or ARB2 or
      - Calcium-Channel Blocker (dihydropyridine) or
      - Thiazide Diuretic

- Sequential Mono-therapy with above

- 2-Combination therapy
  - ACEI/ARB2 + Calcium-channel blocker or
  - ACEI/ARB2 + Thiazide diuretic or
  - Calcium-channel blocker + Thiazide diuretic
HTN Management: Pharmacologic Therapy

• **Mono-therapy**
  - **Sequential Mono-therapy**
    - Wide inter-patient response variability
    - Some may respond to one drug but not to another
    - A single first line drug: 30-50% efficacy
    - Switching (not adding) drugs: 60-80% efficacy
  - **Preferred Classes (long-acting)**
    (No contraindication or compelling indication applies)
    - ACE inhibitor or ARB2
    - Calcium-channel blocker (dihydropyridine)
    - Thiazide diuretic (chlorthalidone)

• **Note:**
  - 1) Beta blockers are no longer considered first line choice unless there is a compelling indication or perhaps in younger patients
  - 2) Avoid short-acting drugs
HTN Management: Pharmacologic Therapy

- **HTN**: BP >20/10 mmHg over target
  - **Life style modification for all**
  - **2-Combination therapy (long-acting)**
    (No contraindication or compelling indication applies)
    - ACEI/ARB2 + Calcium-channel blocker or
    - ACEI/ARB2 + Thiazide diuretic or
    - Calcium-channel blocker + Thiazide diuretic

- **3-Combination therapy (long-acting)**
  - ACEI/ARB2 + Calcium-channel blocker + Thiazide diuretic

- **Add others**
  - Mineralocorticoid Receptor-Blocker
  - Vasodilator Beta-Blocker
HTN Management: Pharmacologic Therapy

• **Combination therapy**
  - **2 or even 3 drugs at ½ standard dose**
  - May be more effective than 1 drug (at standard or twice standard dose)
  - Less side effect
HTN Management: Pharmacologic Therapy

• Combination Therapy
  • Preferred (long acting)  
    (No contraindication or compelling indication applies):
    • ACE inhibitor/ARB2 + Calcium-channel blocker
      • (ACCOMPLISH trial: benazepril + amlodipine)
      • ACE inhibitor/ARB2 + Thiazide diuretic
  • Acceptable:
    • Calcium-channel blocker + Thiazide diuretic
  • Avoid:
    • ACE inhibitor + ARB2
    • ACE inhibitor/ARB2 + Beta-blocker
    • Verapamil/Diltiazem + Beta-blocker
HTN Management: Pharmacologic Therapy

- **Thiazide Diuretics**
  - **Chlorthalidone:**
    - Superior BP reduction compared with HCTZ
    - Diuretic used in most of the major HTN trials
    - Longer duration of action
    - More is known about the long-term benefits
  - **Hydrochlorothiazide:**
    - Commonly used
    - Available in most fixed-dose combination agents
    - May have less risk for hypokalemia, glucose intolerance or new onset DM
# HTN Management: Pharmacologic Therapy

## Medications: Compelling Indications

<table>
<thead>
<tr>
<th>Condition</th>
<th>HTN Medication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Systolic heart failure</td>
<td>ACE inhibitor/ARB2, Beta-blocker, Diuretic, Aldosterone antagonist</td>
</tr>
<tr>
<td>Post-MI</td>
<td>ACE inhibitor, Beta-blocker, Aldosterone antagonist</td>
</tr>
<tr>
<td>Proteinuric chronic kidney disease</td>
<td>ACE inhibitor/ARB2</td>
</tr>
<tr>
<td>Angina pectoris</td>
<td>Beta-blocker, Calcium-channel blocker</td>
</tr>
<tr>
<td>Atrial fibrillation/flutter</td>
<td>Beta-blocker, Calcium-channel blocker (non-dihydropyridine)</td>
</tr>
<tr>
<td>Diabetes</td>
<td>ACE inhibitor/ARB2, Calcium-channel blocker, Beta-blocker, Diuretic</td>
</tr>
<tr>
<td>Stroke</td>
<td>ACE inhibitor, Diuretic</td>
</tr>
</tbody>
</table>
## Medications: Favorable Effects

<table>
<thead>
<tr>
<th>Conditions</th>
<th>HTN Medication</th>
</tr>
</thead>
<tbody>
<tr>
<td>BPH</td>
<td>Alpha-blocker</td>
</tr>
<tr>
<td>Essential tremor</td>
<td>Beta-blocker (non-cardioselective)</td>
</tr>
<tr>
<td>Hyperthyroidism</td>
<td>Beta-blocker</td>
</tr>
<tr>
<td>Migraine</td>
<td>Beta-blocker, Calcium-channel blocker</td>
</tr>
<tr>
<td>Osteoporosis</td>
<td>Thiazide diuretics</td>
</tr>
<tr>
<td>Peri-operative HTN</td>
<td>Beta-blocker</td>
</tr>
<tr>
<td>Raynaud’s</td>
<td>Calcium-channel blocker (dihydropyridine)</td>
</tr>
</tbody>
</table>
### HTN Management: Pharmacologic Therapy

**Medications: Contraindications**

<table>
<thead>
<tr>
<th>Conditions</th>
<th>HTN Medication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angioedema</td>
<td>ACE inhibitor</td>
</tr>
<tr>
<td>Bronchospasm/Asthma</td>
<td>Beta-blocker</td>
</tr>
<tr>
<td>Depression</td>
<td>Reserpine</td>
</tr>
<tr>
<td>Liver disease</td>
<td>Metyldopa</td>
</tr>
<tr>
<td>Pregnancy</td>
<td>Ace inhibitor/ARB2</td>
</tr>
<tr>
<td>2nd-3rd Heart Block</td>
<td>Beta-blocker, Calcium-channel blocker (non-dihydropyridine)</td>
</tr>
</tbody>
</table>
## HTN Management: Pharmacologic Therapy

### Medications: Adverse Effects

<table>
<thead>
<tr>
<th>Conditions</th>
<th>HTN Medication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depression</td>
<td>Beta-blocker, Central Alpha-agonist</td>
</tr>
<tr>
<td>Gout</td>
<td>Diuretic</td>
</tr>
<tr>
<td>Hyperkalemia</td>
<td>Ace inhibitor/ARB2, Aldosterone-antagonist</td>
</tr>
<tr>
<td>Hyponatremia</td>
<td>Thiazide diuretic</td>
</tr>
<tr>
<td>Renovascular Disease</td>
<td>Ace inhibitor/ARB2</td>
</tr>
</tbody>
</table>
## HTN Management: Pharmacologic Therapy

<table>
<thead>
<tr>
<th>Class</th>
<th>Drug</th>
<th>Dose</th>
<th>Cost/mon</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thiazide Diuretic</td>
<td>Chlorthalidone</td>
<td>25mg</td>
<td>$15</td>
</tr>
<tr>
<td></td>
<td>Hydrochlorthiazide</td>
<td>12.5-25mg</td>
<td>$5</td>
</tr>
<tr>
<td>ACEI</td>
<td>Lisinopril</td>
<td>10mg</td>
<td>$15</td>
</tr>
<tr>
<td></td>
<td>Benazapril</td>
<td>10mg</td>
<td>$25</td>
</tr>
<tr>
<td>ARB</td>
<td>Irbezartan</td>
<td>150mg</td>
<td>$50</td>
</tr>
<tr>
<td></td>
<td>Losartan</td>
<td>50mg</td>
<td>$60</td>
</tr>
<tr>
<td>CCB</td>
<td>Amlodipine</td>
<td>5mg</td>
<td>$8</td>
</tr>
</tbody>
</table>
# HTN Management: Pharmacologic Therapy

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<tr>
<th>Class</th>
<th>Drug</th>
<th>Dose</th>
<th>Cost/mon</th>
</tr>
</thead>
<tbody>
<tr>
<td>CCB/ACEI</td>
<td>Amlodipine/Benazapril</td>
<td>5mg/10mg</td>
<td>$80</td>
</tr>
<tr>
<td>ACEI/Thiazide</td>
<td>Lisinopril/HCTZ</td>
<td>10/12.5mg</td>
<td>$25</td>
</tr>
<tr>
<td></td>
<td>Benazapril/HCTZ</td>
<td>10mg/12.5mg</td>
<td>$25</td>
</tr>
<tr>
<td>ARB/Thiazide</td>
<td>Irbesartan/HCTZ</td>
<td>150mg/12.5mg</td>
<td>$60</td>
</tr>
<tr>
<td></td>
<td>Losartan/HCTZ</td>
<td>50mg/12.5mg</td>
<td>$70</td>
</tr>
<tr>
<td>Thiazide Diuretic</td>
<td>Hydrochlorothiazide</td>
<td>12.5-25mg</td>
<td>$5</td>
</tr>
<tr>
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<td>Lisinopril</td>
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<tr>
<td>CCB</td>
<td>Amlodipine</td>
<td>5mg</td>
<td>$8</td>
</tr>
</tbody>
</table>

**Note:** Costs may vary depending on location and insurance coverage.
HTN Management: Goal BP

• For every one:
  • SBP and DBP <140/90 mmHg

• In patients with DM or renal disease*:
  • BP goal is <130/80 mmHg

• *Proteinuria >300-1,000mg/dL
HTN Management
BP Monitoring

• Follow-up
  • 1-4 week follow-up intervals (depending on severity)
    • Adjust medications until the BP goal is reached
  • 3-6 month follow-up intervals
    • after BP is at goal and stable
• Yearly monitor
  • Serum K and creatinine, urine micro-albuminuria
• More frequent follow-up with stage 2 HTN or with complicating comorbid conditions
  • HF, DM
  • Other CV risk factors
VI. SPECIAL POPULATIONS
Special Population: Oral Contraceptives

• OC and BP
  • Many experience a small but detectable increase in BP
  • A small percentage experience onset of frank HTN
  • OC may precipitate accelerated or malignant HTN

• Risk factors for susceptibility to HTN include:
  • Pregnancy-induced HTN
  • Occult renal disease
  • Obesity
  • Age >35 years
  • Duration of use
  • Family history of HTN
Special Population: Oral Contraceptives

- Regular monitoring of BP is recommended
  - Follow-up BP 3 months after start of OC
  - Some suggest Rx be limited to 6 months to ensure semi-annual reevaluations

- Management of contraceptive-induced HTN
  - Withdrawal of OC
    - Use of other contraceptive methods is generally desirable
    - BP usually returns to normal within 3 months
  - OC may have to be continued in some women
    - Combined with anti-HTN therapy if other contraceptive methods are not suitable
**Special Population: Pregnancy**

- **Women with HTN planning Pregnancy**
  - ACEIs and ARBs should be discontinued
    - Prior to attempts at conception
    - As soon as pregnancy is confirmed

- **HTN and Pregnancy**
  - **Stage I Mild and Uncomplicated HTN**
    - With careful monitoring, many women can be managed without HTN medication
    - Target Goal: BP <150/100mmHg
  - **Complicated Stage I or Stage II HTN**
    - Methyldopa or Labetalol are first-line therapy
    - Methyldopa is preferred by many as first-line therapy
    - Metoprolol, Thiazide diuretics, and Calcium-channel blockers are second-line therapy
Special Population: Breastfeeding

• HTN and Breastfeeding:
  • All antihypertensive drugs are excreted into human breast milk.
  • Stage I Mild and Uncomplicated HTN
    • With careful monitoring, it may be prudent to withhold HTN medications
    • Resume HTN medications upon discontinuation of breastfeeding
  • Complicated Stage I or Stage II HTN
    • Methyldopa or Labetalol/Propranolol
    • ACE Inhibitors and ARBs should be avoided
    • Diuretics may reduce milk volume and thereby suppress lactation
1. Assess BP prior to training for competitive athletics
   - Pre-HTN
     • Should be encouraged to modify lifestyle
     • Should not be restricted from physical activity
   - BP >140/90
     • Measure out-of-office BP to exclude “white-coat”
   - Sustained HTN >140/90
     • Should have echocardiography

2. Stage 1 HTN without TOD, LVH or other heart disease
   - Control BP by either lifestyle modification or drug therapy
   - Check the BP every 2-4 months to monitor the impact of exercise
   - Should not limit the eligibility for any competitive sport
3. Stage 2 HTN without TOD, LVH or other heart disease
   - Should be restricted, particularly from high static sports (classes IIIA to IIIC), until HTN is controlled by either lifestyle modification or drug therapy

4. HTN with another CV disease
   - Eligibility for participation in competitive athletics is usually based on the type and severity of the associated condition

5. All drugs being taken must be registered with appropriate governing bodies to obtain a therapeutic exemption
Clinical Cases
HTN: Clinical Case 1
Clinical History

• Clinical Presentation
  • 19 y o man, new patient, on the row team, presents with a c/o nasal congestion, sore throat and cough, for 3 days
  • In triage his BP was noted to be 170/110

• Medications:
  • OTC Dayquil, Adderall 10 mg twice daily

• Past Medical History
  • ADD

• Family History
  • Mother: HTN

• Social History
  • ETOH: 8 drinks a week; >5 drinks/day 2X a month

• ROS
  • Negative
HTN: Clinical Case 1
Physical Examination

• Vital Signs
  • BP average of 3 after resting
    • BP 170/110 R arm
    • BP 168/108 L arm

• Physical exam
  • Normal

• Management
  • You advise him on URI self care, to stop the pseudoephedrine, hold the Adderall and taper off the caffeine
  • You counsel him on lifestyle modification
HTN: Clinical Case 1
Management

• In addition which of the following is the most reasonable:

  • A) Prescribe a Z-Pac and follow up on Monday after he returns from the competition.
  • B) Follow up for a BP check within 3 days; no strenuous exertion in the mean time.
  • C) Start Thiazide Diuretic and follow up within 3 days; no strenuous exertion in the mean time.
  • D) Start Thiazide Diuretic and ACE Inhibitor and follow up within 3 days; no strenuous exertion in the mean time.
  • E) Refer to ER for immediate evaluation and management of his HTN
In addition which of the following is the most reasonable:

- **A)** Prescribe a Z-Pac and follow up on Monday after he returns from the competition.
- **B)** Follow up for a BP check within 3 days; no strenuous exertion in the mean time.
- **C)** Start Thiazide Diuretic and follow up within 3 days; no strenuous exertion in the mean time.
- **D)** Start Thiazide Diuretic and ACE Inhibitor and follow up within 3 days; no strenuous exertion in the mean time.
- **E)** Refer to ER for immediate evaluation and management of his HTN
HTN: Clinical Case 1
Follow-up

- On follow up visits, after stopping decongestants, caffeine and Adderall, his BP remains persistently elevated, 154/96
- Routine laboratory testing:
  - CBC  normal
  - FBS  88 mg/dl
  - Hgb A1C  5.2%
  - Sodium  141 mg/dl
  - K  3.3 mg/dl (low)
  - HCO3  32 meq/dL (high)
  - BUN  19 mg/dl
  - Cr  0.7 mg/dl
- ECG normal no LVH
- Calcium  10 mg/dL
- TSH  3.2 mIU/L
- UA  normal
- Spot ur  normal
In addition to starting HTN medication, what further testing should be done?

- **A) No need for further work-up**
  - It’s primary HTN
- **B) Renal doppler**
  - R/O fibromuscular displasia
- **C) Renal sonogram**
  - R/O renal parenchymal disease
- **D) Plasma renin activity and aldosterone**
  - R/O primary hyperaldosteronism
- **E) 24-hour urine for metanephrines**
  - R/O pheochromocytoma
In addition to starting HTN medication, what further testing should be done?

A) No need for further work-up
   - It’s primary HTN

B) Renal doppler
   - R/O fibromuscular displasia

C) Renal sonogram
   - R/O renal parenchymal disease

D) Plasma renin activity and aldosterone
   - R/O primary hyperaldosteronism

E) 24-hour urine for metanephrines
   - R/O pheochromocytoma
HTN: Clinical Case 1
Follow-up

• BP is now controlled 130/82 on medication.
• Patient needs clearance to return to rowing competition.
• You advise which of the following:
  • A) No further work-up, he can resume full activity without restriction
  • B) He needs an Echocardiogram; if normal, he can resume full activity without restriction
  • C) He should NOT resume any high intensity activity including rowing
HTN: Clinical Case 1 Follow-up

• BP is now controlled 130/82 on medication.
• Patient needs clearance to return to rowing competition.
• You advise which of the following:
  • A) No further work-up, he can resume full activity without restriction
  • B) He needs an Echocardiogram; if normal, he can resume full activity without restriction
  • C) He should NOT resume any high intensity activity including rowing
HTN: Clinical Case 2

• 20 y.o. woman for a 3-month follow-up after starting an estrogen/progestin OCP
  • BP is now 156/96 (baseline BP 132/84)
  • BMI is now 26 (baseline 24)

• You advise her on lifestyle modification including weight loss and repeat BP check in one month

• In addition, which of the following would be the most reasonable:
  • A) Continue the current pill
  • B) Continue current pill and start amlodipine 5 mg daily
  • C) Change to a progestin only pill
  • D) Stop the pill and advise other non-hormonal birth control
20 y.o. woman for a 3-month follow-up after starting an estrogen/progestin OCP
- BP is now 156/96 (baseline BP 132/84)
- BMI is now 26 (baseline 24)

You advise her on lifestyle modification including weight loss and repeat BP check in one month

In addition, which of the following would be the most reasonable:
- A) Continue the current pill
- B) Continue current pill and start amlodipine 5 mg daily
- C) Change to a progestin only pill
- D) Stop the pill and advise other non-hormonal birth control
HTN: Clinical Case 2

• She followed-up with her PMD
  • BP was persistently elevated despite stopping the OCP
  • She was started on Lisinopril 5 mg daily

• She comes for follow-up at the Health Services for missed menstrual period
  • HCG test is positive (estimate 7 weeks pregnant)
  • BP is 140/90 on Lisinopril

• What is the next best step?
  • A) Continue Lisinopril, recheck BP in 2 weeks
  • B) Stop Lisinopril and start Amlodipine 5 mg daily, recheck BP in 2 weeks
  • C) Stop Lisinopril and start Methyldopa 250 mg BID, recheck BP in 2 weeks
  • D) Stop Lisinopril and recheck BP in 2 weeks
HTN: Clinical Case 2

• She followed-up with her PMD
  • BP was persistently elevated despite stopping the OCP
  • She was started on Lisinopril 5 mg daily
• She comes for follow-up at the Health Services for missed menstrual period
  • HCG test is positive (estimate 7 weeks pregnant)
  • BP is 140/90 on Lisinopril
• What is the next best step?
  • A) Continue Lisinopril, recheck BP in 2 weeks
  • B) Stop Lisinopril and start Amlodipine 5 mg daily, recheck BP in 2 weeks
  • C) Stop Lisinopril and start Methyldopa 250 mg BID, recheck BP in 2 weeks
  • D) Stop Lisinopril and recheck BP in 2 weeks
JNC-8
What’s to be Expected?
JNC 8?
Expect some Changes

- Changes in BP definition/diagnosis
- Use of Self-Home BP monitoring
- ACE inhibitors/ARBs, CCBs, thiazide diuretics will be the first-line therapy
- Beta blockers unless with a compelling indication will likely be a second line line
- Discrepancy in efficacy between chlorthalidone or indapamide vs. hydrochlorothiazide will likely be delineated.
- For Monotherapy, sequential Mono-therapy may be favored instead of immediately switching to an Add-on or Combination therapy
- For Combination therapy (2-3 drugs), combining ACE inhibitors/ARBs, CCBs, and diuretics will be the preferred management.
References

- National Heart, Lung, and Blood Institute (NHLBI)
  - The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC 7)
- National Institute for Health and Clinical Excellence (NICE)
- National Kidney Foundation (NKF)
- American Society of Hypertension (ASH) Position Papers
- American Diabetes Association (ADA)
  - Search Clinical Practice Recommendations
- Hypertension Canada Guidelines
- European Society of Hypertension (ESH)
  - http://www.eshonline.org/
- The International Society of Hypertension (ISH) and World Health Organization
- American Heart Association Council for High Blood Pressure Research and the Councils on Clinical Cardiology and Epidemiology and Prevention
  - http://www.circ.ahajournals.org/cgi/content/full/115/21/2761
**HTN Diagnosis:**
Home BP Monitoring (HBPM)

- [http://www.dableducational.org/](http://www.dableducational.org/)

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<th>Device</th>
<th>Oscillation</th>
<th>Pass</th>
<th>A/A</th>
<th>Minor recruitment modification</th>
<th>Children and adolescents. Reasonable adaptation of protocol.</th>
<th>Recommended</th>
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<tr>
<td>Omron 705IT (HEM-759-E)</td>
<td>Pass</td>
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