Outcomes:
1. Select and recommend appropriate antihypertensive treatment when indicated.
2. Monitor for efficacy, adverse effects, and toxicity associated with antihypertensive therapy.
3. Evaluate the appropriateness of patient specific antihypertensive therapy and modify therapy as needed.
4. Educate patients and health-care professionals regarding antihypertensive therapy.

Required readings:
3. Evidence Based Medicine-Statistics link at: http://facpub.stjohns.edu/~sees/FMsite/index.shtm

Instructions:
In preparation for this class, complete the bolded sections of the study guide that follow.
I. Introduction
A. Incidence

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Awareness</td>
<td>51%</td>
<td>73%</td>
<td>68.4%</td>
<td>70%</td>
</tr>
<tr>
<td>Treatment</td>
<td>31%</td>
<td>55%</td>
<td>53.6%</td>
<td>59%</td>
</tr>
<tr>
<td>Control</td>
<td>10%</td>
<td>29%</td>
<td>27.4%</td>
<td>34%</td>
</tr>
</tbody>
</table>


B. Complications of HTN
1. CVA
2. MI
3. ESRD
4. Stroke
5. Retinopathies
6. LV hypertrophy
7. CHD
8. CHF

C. Etiology
1. Primary (primary or essential htn)-unknown etiology
   a. Genetic
   b. Nitric oxide
2. Secondary (10%)
   a. Pheochromocytoma
   b. HyperPTH
   c. Hypothyroidism
   d. Primary aldosteronism
   e. Coarctation of the aorta
   f. Cushing’s syndrome
   g. Drugs

Please list 6 drugs that can cause hypertension. (6)
1.
2.
3.
4.
5.
6.
3. Other
   a. Renin-angiotensin-aldosterone system

   Angiotensinogen (liver)
   \[\xrightarrow{\text{Renin (kidney)}}\]
   Angiotensin I
   \[\xrightarrow{\text{ACE}}\]
   Angiotensin II
   \[\xrightarrow{\text{Aldosterone}}\]
   Bradykinin
   Inactive Fragments

   b. Sodium

D. Cardiovascular Risk Factors
   a. HTN
   b. Smoking
   c. Obesity (BMI>30)

What is Metabolic Syndrome? (4)

d. Physical inactivity
e. Dyslipidemia
f. Microalbuminuria
g. Age (>55 men, >65 women)
h. FH of premature CV dz (men <55 yrs, women 65 yrs)
I. Goals

<table>
<thead>
<tr>
<th>Category</th>
<th>Systolic (mmHg)</th>
<th>Diastolic (mm Hg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>&lt; 120</td>
<td>&lt; 80</td>
</tr>
<tr>
<td>Pre-hypertension</td>
<td>120-139</td>
<td>80-89</td>
</tr>
<tr>
<td>Stage 1</td>
<td>140-159</td>
<td>90-99</td>
</tr>
<tr>
<td>Stage 2</td>
<td>≥160</td>
<td>≥100</td>
</tr>
</tbody>
</table>

GF presents to the family medicine clinic with a BP of 165/90. What stage htn is he in? Explain. (2)

Diabetics or Renal disease + HTN ≤ 130/80

II. Clinical Presentation
A. Usually asymptomatic
B. Labs Prior to Drug Tx: H/H, UA, K, Cr, LFT, EKG, lipid profile, glucose, UA
C. TOD: AV nicking, retinal hemorrhage, in facts, papilledema, +S2, systolic ejection murmur, s4 gilup, s3 gilup

III. Diagnosis
A. Must have 2 readings on subsequent days to make diagnosis
B. ABPM

IV. Monitoring
A. What affects BP readings?
   1. Time of day
   2. Timing of meals
   3. Physical activity
   4. Environmental temp
   5. Posture
   6. Emotions

B. Frequency

- Once drug is initiated: can follow up monthly until BP goal achieved
- If blood pressure remains uncontrolled after 1-2 months, consider increasing the dose or adding another drug
- Monitor Cr and K at least 1-2x per year
- Once BP is stable, may extend f/u at 3-6 month intervals
- Co-morbid diseases may require more frequent monitoring (HF, DM)
V. Nonpharmacologic Treatment
A. Weight loss
B. Diet rich in fruits and veggies
C. Restrict salt intake (2.4g Na)
D. Reduce ETOH (24oz beer = 10oz wine = 2 oz of 100proof whiskey= 10oz wine)
E. Smoking cessation
F. Exercise

VI. Pharmacologic Treatment
A. Diuretics
1. Thiazides are more effective than loops (if CrCl>30ml/min)
2. Good adjunct tx
3. Thiazide MOAs
   a. ↓ plasma volume, SV (CO)
   b. Mobilize Na, H2O from arteriolar walls
   c. Change electrolyte composition of intraarteriolar walls, vascular responsiveness
   d. Direct relaxation of smooth muscle
4. Thiazide Ses: HypoK, hypoMg, HyperCa, hyperuricemia, hyperglycemia, hyperlipidemia (transient), sexual dysfunction, volume depletion
5. Loop Diuretics-indicated in renal impairment, those requiring potent diuresis; Ses: same without hyperlipidemia, hyperglycemia

B. Central Alpha 2 Agonists
1. MOA: reduce sympathetic outflow from brain, increases vagal tone
2. Ses: sedation and dry mouth
3. Rebound htn with abrupt cessation (with any antihtn) but rare for alpha 2s
4. Clonidine Transdermal Patch-Disadvantages
   a. Cost
   b. Rash/skin irritation
   c. Delayed onset (overlap with PO by 2 days)

C. Peripheral Alpha 1 Blockers
1. MOA: Block postsynaptic alpha 1 adrenergic receptors; arterial, venous dilation ↓ total peripheral resistance. Also ↓ total cholesterol, ↑ HDL, improves glucose tolerance, and ↑ urine flow in BPH by relaxing smooth muscle tone in bladder neck/prostate.
2. SE: lassitude, vivid dreams, depression, priapism
3. First Dose Phenomenon-dizziness, syncope, palpitations, faintness, orthostatic hypotension
D. Beta Blockers
1. MOA: negative inotropes/chronotropes

2. Which BB is the most hydrophilic?
   a. Atenolol

<table>
<thead>
<tr>
<th>B1 Selective Agents</th>
<th>BB with ISA*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bisoprolol</td>
<td>Penbutolol</td>
</tr>
<tr>
<td>Atenolol</td>
<td>Carbutolol</td>
</tr>
<tr>
<td>Metoprolol</td>
<td>Pindolol</td>
</tr>
<tr>
<td>Acebutolol</td>
<td>Acebutolol</td>
</tr>
</tbody>
</table>

*Theoretically useful in CHF, PVD, sinus bradycardia
*Can maintain normal basal sympathetic tone while blocking adrenergic excess (so no effect on HR, CO, peripheral Q)

3. Ses: Bradycardia, masks symptoms of hypoglycemia, AV conduction abnormalities, negative inotrope, bronchospasm, ↑ TG, ↓ HDL, CNS-fatigue, depression, nightmares, insomnia, lethargy

E. ACEIs
1. MOA: supress AII, potentiates bradykinins
2. Ses: cough, hyperK, dysguesia (captopril), neutropenia, agranulocytosis, proteinuria, glomerulonephritis, angioedema, renal failure in renal artery stenosis

What is the mechanism behind ACEI induced cough and angioedema? (2)

3. Most effective in high renin states: elderly, whites
4. CI: pregnancy, renal artery stenosis, RAS in a solitary kidney
5. ACEIS in Renal Disease:
   a. Can expect 30% increase in Cr within first 2 months of initiation
   b. So most pts who qualify should be on an ACEI!
   c. When to D/C ACEI:
      -if rise in CR exceeds 30% over baseline
      -if K > 5.6

What is the pathogenesis of ACEI induced nephropathy (5)?

F. ARBs
1. MOA: blocks AT2 receptors
2. Ses: less cough, hyperK, angioedema, headache, asthenia
3. Contraindications: pregnancy

G. Calcium channel blockers
1. Cardiac (Negative inotrope, chronotrope)
   Verapamil > Diltiazem > Nifedipine
2. Peripheral vasodilation
   Nifedipine > Diltiazem > Verapamil
3. Agents

<table>
<thead>
<tr>
<th>Nondihydropyridines</th>
<th>Dihydropyridines</th>
</tr>
</thead>
<tbody>
<tr>
<td>Verapamil</td>
<td>Nifedipine</td>
</tr>
<tr>
<td>Diltiazem</td>
<td>Amlodipine</td>
</tr>
<tr>
<td></td>
<td>Felodipine</td>
</tr>
</tbody>
</table>

4. Benefits: Angina, PVST, Raynaud’s disease
5. CI: CHF, sick sinus syndrome, 1st degree heart block
6. SE: NDP-constipation, HA, heart block, (-) inotrope
   DHP-HA, tachycardia, edema due to venous dilation, nifedipine may ↑ proteinuria in DM
H. Peripheral Sympatholytics (Reserpine, Guanethidine)
1. MOA: Depletes NE from postganglionic adrenergic neurons
2. Old drug, but still useful
3. ADV-QD dosing, inexpensive
4. SE: Depression, drowsiness, weakness, GI disturbance, nasal congestion, sexual dysfunction, bradycardia
5. CI: Pts with hx of mental depression, active PUD, UC, current electroconvulsive therapy

I. Vasodilators (Hydralazine, Minoxidil)
1. MOA: Vasodilator that reduces total peripheral resistance by direct action on smooth muscle
2. SE: Hydralazine-dose dependant SLE, tachycardia, angina
   Minoxidil-hypertrichosis, fluid retention, pericardial effusion

VII. Treatment Algorithm

John M. is a 52-year-old African American. He is 5'9" tall and weighs 190 lb. His body mass index (BMI) is 27.3. John smokes a pack of cigarettes per day. His blood pressure, taken both in the office and at his home, is 144/90. He has no other obvious health problems and his lipid values are unremarkable. What initial therapy would you recommend? (2)

a) None, stress need to stop smoking, reevaluate in 6 months.
b) Life-style modifications, especially tobacco use, reevaluate in 6 months.
c) Intervention with diuretic therapy plus life-style modifications, especially tobacco use, reevaluate in 2 to 6 months.
d) Monotherapy with beta-blocker or angiotensin converting enzyme (ACE) inhibitor in combination with life-style modification, especially tobacco use; reevaluate in 2 to 6 months to assess need to add diuretic therapy or otherwise modify dosage.

WT is a 62 yo Caucasian male with a history of HTN and asthma. He currently takes HCTZ 25mg qd and uses an albuterol inhaler. He comes to clinic with complaints of heart palpitations. An EKG reveals that he is in AFIB with a HR of 160 bpm. His BP is 150/100 mmHG. Which of the following is the best management for his HTN? (2)

a) add verapamil SR 120mg qd
b) add atenolol 25mg qd
c) add hydralazine 25mg tid
d) add doxazosin 5mg qd

TJ is a 45 yo AA female with Type 2 DM treated with glyburide 5mg qd. Her BP during the last 3 visits has ranged from 132-138/86-88 mmHg. Today, her BP is 138/88 mmHg, HR is 70bpm, and labs are Na=140 meq/L, K=4 meq/L, CL=102 meq/L, CO2=28meq/L, BUN=14 mg/dl, and SCr 1.5 mg/dl. Which of the following is the best management for her HTN at this time? (2)

a) no treatment is necessary bc her BP is below goal
b) start lifestyle modifications alone
c) start lisinopril 5mg qd + lifestyle modifications
d) start HCTZ 25mg qd + lifestyle modifications
DW is a 50 yo African American man who is being discharged from the hospital following an acute myocardial infarction. His PMH: HTN. He was taking HCTZ 25mg qd before hospitalization. An ECHO prior to discharge shows a normal EF of >60%. His vital signs today are BP 150/94mmHg and HR 80 bpm. Which one of the following is the most appropriate approach to manage his HTN? (2)

a) D/C HCTZ, add diltiazem  
b) Continue HCTZ, add metoprolol  
c) D/C HCTZ, add losartan  
d) Continue HCTZ, add losartan

VIII. HTN Urgency and Emergency  
A. Please compare/contrast HTN Urgency and Emergency and provide examples of each:

<table>
<thead>
<tr>
<th>Hypertensive Urgency (6)</th>
<th>Hypertensive Emergency (6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Define</td>
<td></td>
</tr>
<tr>
<td>Examples</td>
<td></td>
</tr>
</tbody>
</table>

B. Goal of HTN Emergency  
1. Lower mean arterial bp by no more than 25% (w/in min to 2 hours), then toward 160/100 mmHg w/in 2-6 hrs

IX. Compelling Indications  
Please fill in the following table: (6)

<table>
<thead>
<tr>
<th>Disease</th>
<th>Recommended Drugs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ischemic Heart Disease</td>
<td></td>
</tr>
<tr>
<td>Acute coronary syndromes (MI/unstable angina)</td>
<td></td>
</tr>
<tr>
<td>Post MI</td>
<td></td>
</tr>
<tr>
<td>Heart Failure</td>
<td></td>
</tr>
<tr>
<td>Diabetes</td>
<td></td>
</tr>
<tr>
<td>Cerebrovascular Disease</td>
<td></td>
</tr>
</tbody>
</table>
X. ALLHAT Study  
(See #3 under required readings)

Please use the following table to answer the next question:

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Amlodipine vs Chlorthalidone</th>
<th>Lisinopril vs Chlorthalidone</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RR (95%CI)</td>
<td>P value</td>
</tr>
<tr>
<td>Primary</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-CHD</td>
<td>0.98 (0.90-1.07)</td>
<td>0.65</td>
</tr>
<tr>
<td>Secondary</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-All cause mortality</td>
<td>0.96 (0.89-1.02)</td>
<td>0.20</td>
</tr>
<tr>
<td>-Combined CHD*</td>
<td>1.00 (0.94-1.07)</td>
<td>0.97</td>
</tr>
<tr>
<td>-Stroke</td>
<td>0.93 (0.82-1.06)</td>
<td>0.28</td>
</tr>
<tr>
<td>-Combined CVD**</td>
<td>1.04 (0.99-1.09)</td>
<td>0.12</td>
</tr>
</tbody>
</table>

* Combined CHD=CHD death, nonfatal MI, coronary revascularization procedures, and hospitalized angina
** Combined CVD=CHD death, nonfatal MI, stroke, coronary revascularization procedures, hospitalized or treated angina, HF, and peripheral arterial disease

Question: Please explain the significant results of the ALLHAT study using the above table. (do not repeat the statistics, use your own words to explain...be BRIEF!) (5 points)