

HYPERTENSION

What is it and How do we manage it?

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Department of Cardiovascular Surgery


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Disclosure

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- Nothing to Disclose

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Objectives

- Discuss the prevalence and impact of hypertension
- Discuss the pathophysiology of hypertension and how it can effect the body
- Discuss the two classes of hypertension
- Discuss the latest guidelines for treating hypertension
- Discuss the classifications of drug therapy and the nonpharmacologic recommendations for treating hypertension

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What's the Big Deal?

HARD NUMBERS

- 1 MILLION people with hypertension
- 16.5 MILLION people with hypertension
- 795,000 people with hypertension
- 355,000 people with hypertension

Hypertension: More Common Than You Think

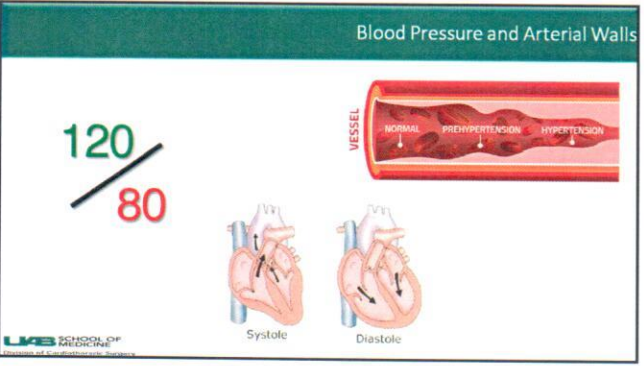
Although it goes beyond health risks, high blood pressure typically has no symptoms - so it often goes undetected.

- 1 in 3 adults worldwide have high blood pressure
- 1 in 4 adults in the US have high blood pressure
- 1 in 5 adults with high blood pressure are unaware of it

7% from Administrative Data from High Blood Pressure by JCI: Behavioral Medicine

Heart Disease and Stroke Statistics - 2018 Update
https://www.cdc.gov/ddd/data_statistics/fact_sheets/HI_bloodpressure.htm





Classes of Hypertension

Primary – Essential HTN – 90% <ul style="list-style-type: none">• Causes - Modifiable<ul style="list-style-type: none">• Mismanaged diet• Lack of exercise• Stress• Obesity• Smoking• Causes - Not Modifiable<ul style="list-style-type: none">• Age• Race• Family history• Gender	Secondary – 10% <ul style="list-style-type: none">• Diabetes• Chronic Kidney Disease• Endocrine disorders – excess levels of aldosterone, cortisol or catecholamines• Pregnancy• Alcohol addiction• Thyroid dysfunction• Congenital Coarctation of the Aorta• Sleep Apnea• Birth Control Pill• OTC meds – stimulants (amphetamines), diet pills, cold and allergy meds
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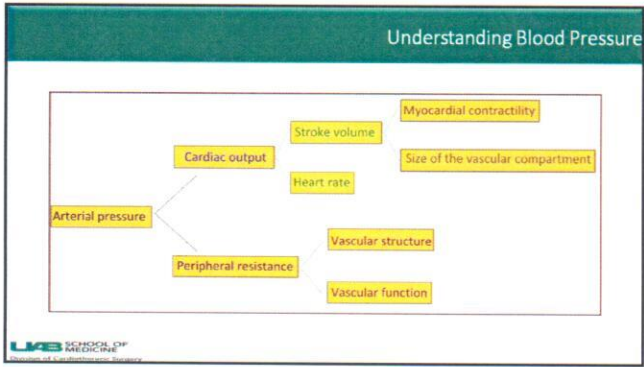
The Silent Killer

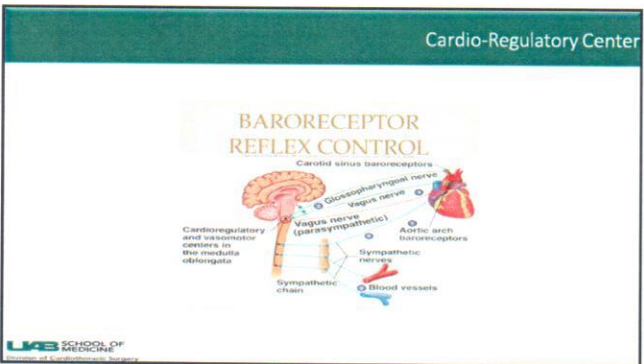
- No signs or symptoms
- Many people don't know they have high BP
- HTN develops slowly over time and can be related to many causes
- HTN cannot be cured but can be managed very effectively
 - Lifestyle modifications → low salt, weight control, exercise
 - Know your numbers
 - Medications - take as prescribed and with in partnership with her medical provider.

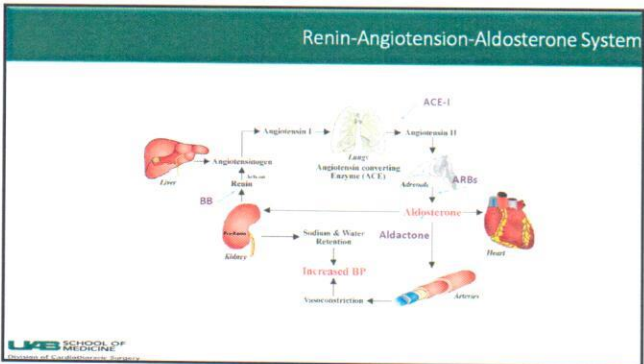
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Effects of Hypertension

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Principles of Drug Therapy

- Individualize therapy (especially in the elderly)
 - What are the mechanism of action - decrease HR, increase UOP
 - What are the side effects - dizziness, constipation, fatigue
 - Consider current disease states - liver and kidney especially
- Choices
 - First the Class of Drug
 - Then the Drug within the Class
- Promote compliance
 - QD dosing vs TID dosing
 - Simplify drug therapy
 - Combination drugs
 - Maximizing doses before adding more


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What's it all about?



CENTERS FOR DISEASE CONTROL AND PREVENTION



AMERICAN SOCIETY OF HYPERTENSION

JNC 7 vs JNC 8


National Heart Lung and Blood Institute


American Heart Association


AMERICAN COLLEGE OF CARDIOLOGY


JAMA
JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION

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Hypertension Classification

Greenland P, Peterson E. The New 2017 ACC/AHA Guidelines "Up the Pressure" on Diagnosis and Treatment of Hypertension. JAMA. 2017;318(21):2083-2084. doi:10.1001/jama.2017.18605

2017 Guideline for the Prevention, Detection, Evaluation and Management of High Blood Pressure in Adults

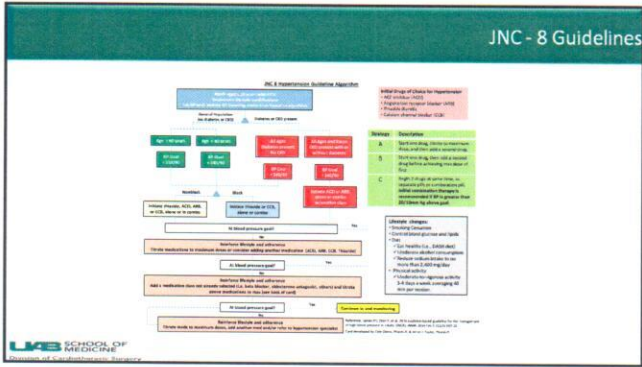
BP Classification (JNC 7 and ACC/AHA Guidelines)

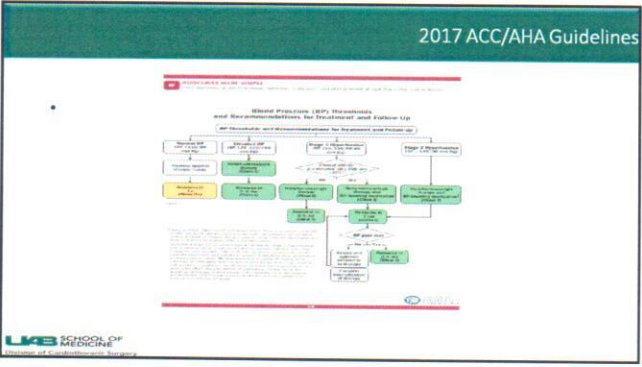
SBP	DBP	JNC 7	2017 ACC/AHA
<120	and <80	Normal BP	Normal BP
120-129	and <80	Prehypertension	Elevated BP
130-139	or 80-89	Prehypertension	Stage 1 Hypertension
140-159	or 90-99	Stage 1 Hypertension	Stage 2 Hypertension
≥160	or ≥100	Stage 2 Hypertension	Stage 2 Hypertension

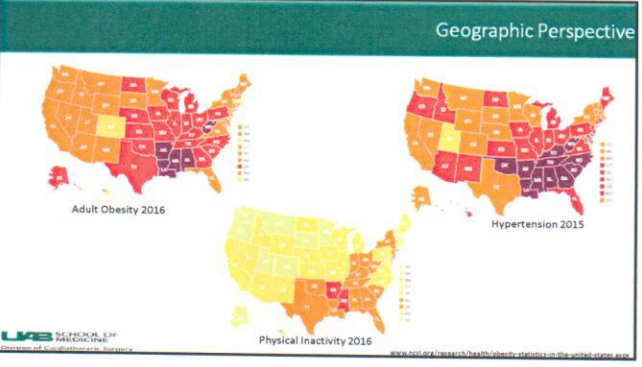
* Blood Pressure should be based on an average of 3 or more readings on 2 occasions.
 † Adults being treated with anti-hypertensive medication should not be classified as having Hypertension.

EMBARKED by
 Date: 01/14/2017

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Non Pharmacologic Recommendations

The American Heart Association recommends for overall cardiovascular health:

- 30** minutes of moderate-intensity aerobic activity 5 days a week
- 150** minutes of moderate-intensity aerobic activity per week
- OR**
- 25** minutes of vigorous-intensity aerobic activity 3 days a week
- 175** minutes of vigorous-intensity aerobic activity per week
- AND**
- HIGH INTENSITY** 12 minutes of high-intensity aerobic activity per week
- 40** minutes of high-intensity aerobic activity per week

The DASH Pyramid shows a diet rich in fruits, vegetables, and low-fat dairy, with moderate protein, whole grains, and nuts. It also includes a 'No Added Salt' sign and a 'No Alcohol' sign.

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Pharmacologic Treatment Options

- ACE-Inhibitors
- Angiotensin Receptor Blockers
- Beta-Blockers
- Calcium Channel Blockers
- Diuretics
- Others
 - Alpha Blockers
 - Central Agonist
 - Vasodilators

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ACE - Inhibitors

- Decrease Preload
- Decrease Afterload
- Blocks formation of Angiotensin that narrows blood vessels
- Causes vasodilation and blocks sodium and water retention
- Protective effect in diabetics and patients with chronic kidney disease
- Benazapril (Lotensin)
- Lisinopril (Zestril)
- Captopril (Capoten)
- Ramipril (Altace)
- Enalapril (Vasotec)
- Trandolapril (Mavik)
- First line therapy
- Generic names end in "pril"

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ACE - Inhibitors

- Side effects
 - Cough
 - Hypotension
 - Hyperkalemia
 - Angioedema
- Types of ACE-I
 - Class I – active as is
 - Captopril
 - Class II – prodrugs (converted to active form in liver)
 - Benazapril, Enalapril, Fosinopril, Moexipril, Perindopril, Quinapril, Ramipril, Trandolapril
 - Class III – water soluble
 - Lisinopril
- Contraindications
 - Hx of angioedema with any ACE-I
 - Avoid with potassium sparing diuretics or any drug that raises K+
 - Acute kidney injury
 - Do not use in combo with ARBs
- Drug class is Tetrogenic

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ACE-I Combination Therapy

- Diuretics
 - Lasix and Thiazides are ok
 - Risk of increase K+ with K+ sparing diuretics
- Ca channel blockers
 - Good combination for HTN
 - Additive effect on BP (vasodilatation)
- Digoxin
 - Good combo with Heart Failure
 - Captopril increases Dig levels
- Nitrates
 - Additive effects on preload reduction
- Beta Blockers
 - Additive effects on decreasing renin activity
- NSAIDS
 - Decrease cough side effect
 - Decrease effects of ACE-I

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Angiotensin Receptor Blockers

- Blocks effects of angiotensin II at its receptor site
- Results in vasodilatation
 - Decrease preload and afterload
- No effect on bradykinin
 - Less cough than ACE-I
 - Less angioedema
- Generic name ends in "sartan"
- Losartan (Cozaar)
- Irbesartan (Avapro)
- Candesartan (Atacand)
- Eprosartan (Teveten)
- Telmisartan (Micardis)
- Valsartan (Diovan)
- Olmesartan (Benecar)
- Drug class is Tetrogenic

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Angiotensin Receptor Blockers

- Similar reduction in mortality and hospitalization in heart failure as ACE-I
- Similar effects in treatment of hypertension as ACE-I
- Slows the progression of proteinuric diabetic and nondiabetic CKD
- Reasonable alternative to ACE-I for all indications (especially if ACE cough)
- Typically very well tolerated class
- Losartan lowers uric acid levels so can be useful with gout
- Do not use in combo with ACE-I

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ACE-I vs ARB

<p>ACE – I “prils”</p> <ul style="list-style-type: none"> • Inhibits conversion of Angiotensin I to Angiotensin II in the lungs • Results in arterial and venous dilation → decreased Na⁺ and H₂O reabsorption (dec preload & afterload) • Protective in DM and CKD • Side effects: cough, hypotension, elevated K⁺ 	<p>ARBs “sartans”</p> <ul style="list-style-type: none"> • Directly blocks Angiotensin II at its receptor site • Results in vasodilation (dec preload & afterload) and decreased volume (dec preload) • No effect on bradykinin • Similar effects in mortality in HF and in treatment of HTN as ACE-I • Side effects: less cough and angioedema, hypotension, elevated K⁺
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BOTH DRUGS ARE TETROGENIC

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Beta Blockers

Beta receptor


<ul style="list-style-type: none"> • Beta 1 (heart) <ul style="list-style-type: none"> • Increase Heart Rate • Increase Contractility • Increase Automaticity • Increase conduction velocity (renin release in kidneys) • Beta Blockers <ul style="list-style-type: none"> • Decrease <ul style="list-style-type: none"> • Heart Rate, Contractility, Automaticity, Conduction velocity and renin release in kidneys 	<ul style="list-style-type: none"> • Beta 2 (arteries, veins, lungs) <ul style="list-style-type: none"> • Vasodilatation • Bronchodilatation • Non cardioselective Beta Blockers <ul style="list-style-type: none"> • Decrease vasodilation • Decrease bronchodilatation
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Beta Blockers


- **Nonselective – Blocks Beta1 / Beta2**
 - Propranolol (Inderol)
 - Nadolol (Corgard)
 - Sotalol (Sotacor)
 - Timolol (Blocadren)
- **Cardioselective – Blocks Beta1**
 - Metoprolol (Lopressor)
 - Atenolol (Tenormin)
 - Bebivolol (Bystolic)
 - Esmolol (Brevebloc)
 - Acebutolol (Sectral)
 - Bisoprolol (Zebeta)
- **Combined Alpha / Beta Blocking**
 - Labetalol (Trandate, Normadyne)
 - Carvedilol (Coreg)
- **These are safer in patients with COPD, asthma, diabetes and peripheral vascular disease**

Generic name ends in "olol"




Beta Blockers

- Not first line agent for Hypertension – reserve for patients post MI/CHF
- Monitor HR – can cause bradycardia, heart block
- Avoid use – COPD/Asthma unless Cardioselective BB
- Can cause fatigue, insomnia, nausea
- Can cause in sexual dysfunction
- Symptoms typically get better after several months of use



Calcium Channel Blockers

- Act on depolarization of SA node and AV node cells
- Calcium increases the strength and force of contractions in the heart and blood vessels. CCBs block this entry into the smooth muscles and helps relax the blood vessels
- Some slow the heart rate down
- May work better for older people and African Americans than ACE-I/ARBs
- **Dihydropyridines – works well with BB to control HR.**
 - Amlodipine (Norvasc)
 - Felodipine (Plendil)
 - Nifedipine (Cardene)
 - Nifedipine (Procardia XL)
 - Isradipine (DynaCirc)
- **Non-Dihydropyridines – DO NOT use with BB or Digoxin (toxicity)**
 - Diltiazem (Cardizem CD/SR, Tiазac)
 - Verapamil (Calan SR, Isoptin SR)
- **Generic name ends with "dipine"**



Calcium Channel Blockers

- **Effects on Heart**
 - Decrease HR (except Nifedipine)
 - Decrease contractility (especially Verapamil)
 - Decrease AV conduction velocity
- **Effect on Blood Vessels**
 - Coronary Vasodilation - prevents vasospasm
 - Peripheral Vasodilation - afterload reduction
- **Heart Rate Lowering – relaxes the heart**
 - Verapamil – most depression of contractility
 - Diltiazem
- **Dihydropyridines – potent vasodilator, little depression of contractility**
 - Clevidipine – ultra short acting (IV only)
 - Nifedipine (Procardia) – short acting or can use SR
 - Felodipine – longer acting – little cardiac depression
 - Isradipine - longer acting – little cardiac depression
 - Nicardipine - longer acting – little cardiac depression
 - Amlodipine – long acting, no cardiac depression, safest to use in heart failure

Dihydropyridines - most peripheral vascular effect

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Calcium Channel Blockers

- **Side effects**
 - Bradycardia – Diltiazem, Verapamil
 - AV Block – Diltiazem, Verapamil
 - Hypotension – esp Nifedipine
 - Heart Failure – esp Verapamil
 - Flushing
 - Headaches
 - Peripheral Edema
 - Constipation – esp Verapamil
 - Grapefruit juice interacts with some CCB increase blood levels/side effects
- **Calcium Channel Blockers and Beta Blockers**
 - Have same effect on the heart
 - Have opposite effect on blood vessels

First line therapy especially with AA pts

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Diuretics

- **Potassium Sparing Diuretics**
 - Spironolactone (Aldactone)
 - Triamterene (Dyrenium)
 - Amiloride (Midamor)
- **Loop diuretics**
 - Bumetanide (Bumex)
 - Furosemide (Lasix)
 - Torsemide (Demadex)
- **Thiazide Diuretics – Drug of choice (except pts with Sulfa allergy)**
 - Chlorothiazide (Diuril)
 - Hydrochlorothiazide HCTZ (Microzide)
 - Metolazone (Zaroxolyn)
 - Chlorthalidone (Hygroton)
- **Combination Diuretics**
 - Amiloride/HCTZ (Moduretic)
 - Spironolactone/HCTZ (Aldactazide)
 - Triamterene/HCTZ (Dyazide, Maxzide)

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Diuretics – Things to know

- Increases urination which reduces sodium and fluid in body
- Helps lower blood pressure because it lowers blood volume
- Most commonly used in combination with other HTN meds
- Monitor electrolytes especially K⁺
- Can increase risk for gout
- Caution using Aldactone or Triamterene with ACE-I – both raise K⁺
- Spironolactone can cause gynecomastia in males and hyperkalemia
- Do not use Thiazide diuretics w/ Digoxin
- Loop Diuretics can cause ototoxicity
- Thiazide diuretics are not ototoxic and are well tolerated
- Diuretics are most effective when combined with ACE-I
- Lasix is not known to be teratogenic
- Thiazide diuretics are teratogenic

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Other BP agents

- Alpha Blockers – cause vasodilation – treats prostate enlargement
 - Doxazosin (Cardura)
 - Prazosin (Minipress)
 - Terazosin (Hytrin)
- Central Alpha₂ agonist – work on CNS instead of directly on CV system – vasodilation
 - Can cause drowsiness and dry mouth
 - Can cause constipation
- Clonidine (Catapres)
 - Pills and patches
 - Don't stop abruptly – rebound Hypertension
- Methyropa (Aldomet)
 - One of the oldest but still in use
 - First line if BP develops during pregnancy

Can cause postural hypotension, dry mouth, dizziness

Can cause reflex tachycardia - Available Intravenously

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CAUTIONS

- Asthma
 - Do not use Beta Blockers that aren't cardioselective
 - Can aggravate respiratory condition
- Elderly
 - ACE-I and ARBs are good choices
 - Most diuretics are effective
 - Beta Blockers may not be as effective for pts > 60
 - May choose 2 meds at lower dosages vs one at higher dose
- Pregnancy
 - Methyropa – drug of choice
 - Labetalol
 - Beta Blockers
 - Diuretics – not Thiazide
 - ACE-I and ARBs should never be used
 - Many drugs are Class C and Class D. Other drugs should be chosen when possible – Check prior to prescribing or call OB specialist

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Medication Recap

Make it STOP

Case Study - 50 yr old African American Male

- VS: 6'3 and 350 pounds (BMI 43). HR 88 BPM, BP 178/94
- PMH: HTN, HLD, OSA, gout, GERD, BUN 24 Cr 0.7
- PSH:
 - Smokes 1 ppd
 - ETOH – 1-2 beer most nights and liquor on weekend – “with the boys”
 - Married x 15 yrs. Construction worker
 - No CP – some SOB, LE edema, fatigue especially with hills
 - No regular exercise but stays busy and works hard
- Was previously on meds but lost insurance so no follow-up/meds in 2 yrs

Case Study - 83 yr old Caucasian Male

- VS: 5'10 and 200 pounds (BMI 28). HR 64 BPM, BP 142/70
- PMH: HTN, arthritis - BUN 20, Cr 1.0
- PSH:
 - Married x 60 years Retired
 - Very active – plays golf 3x/wk, strength training in gym 2-3x/wk
 - handyman around house – spends lots of time fixing things, manages land for hunting camp. Likes to take nap in afternoon
 - ETOH – 2-3 “good” JD/night
 - Healthy diet most of time
- Meds: Lisinopril/HCTZ 20/25mg ½ tab daily, Glucosamine daily, Mobic 15mg daily
- Takes BP several times daily – 120-150/70s States when he decreases or doesn't drink JD at night, BP goes up. When he takes 1 whole tab BP meds, BP too low (100/60) and makes him dizzy and tired

