

WHEN HYPERTENSION IS NOT EASILY CONTROLLED



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Conflict of interest statement

I have no conflicts of interest in this presentation to disclose



What is Hypertension?

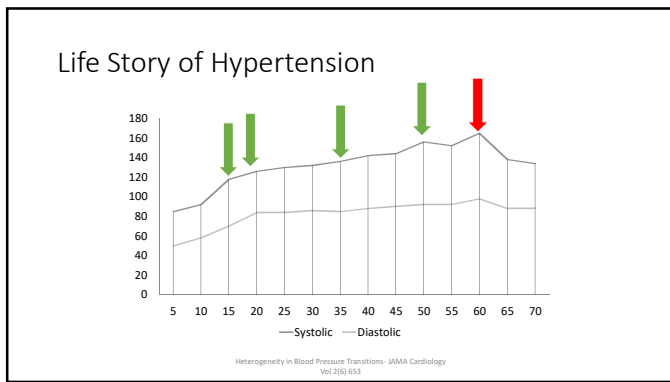


Blood Pressure Categories

BLOOD PRESSURE CATEGORY	SYSTOLIC mm Hg (upper number)	and	DIASTOLIC mm Hg (lower number)
NORMAL	LESS THAN 120	and	LESS THAN 80
ELEVATED	120 – 129	and	LESS THAN 80
HIGH BLOOD PRESSURE (HYPERTENSION) STAGE 1	130 – 139	or	80 – 89
HIGH BLOOD PRESSURE (HYPERTENSION) STAGE 2	140 OR HIGHER	or	90 OR HIGHER
HYPERTENSIVE CRISIS <small>(consult your doctor immediately)</small>	HIGHER THAN 180	and/or	HIGHER THAN 120

Current Blood Pressure Categories

J Am Coll Cardiol. 2017;69(2):e10-43. doi:10.1016/j.jacc.2016.11.014



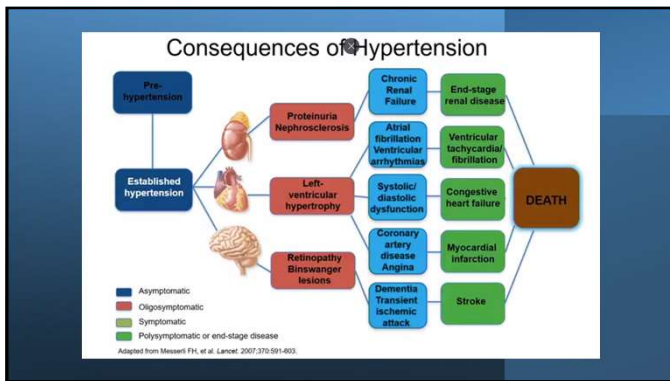


Table 2. Proportion of Patients in the RAMP-HT or Usual Care Achieving Clinical Targets at Baseline and 5 Years

Variable	No. (%) Baseline	HR (%) 5 Yr	OR (95% CI) for RAMP-HT group adjusted for ^a baseline value ^b
SBP (140 mm Hg and SBP <160 mm Hg)			
RAMP-HT participants	57 (40.0)	72 (50.7)	1.37 (0.38-4.80)
Usual care participants	50 (18.0)	55 (20.0)	NA
OR for RAMP-HT achieving target	0.34 (0.03-8.90)	1.51 (1.32-1.80)	NA
LDL-C (<4 mmol/L for Framingham 100-CVD; <5 mmol/L for Framingham 100-CVD non-100%)			
RAMP-HT participants	41 (86.0)	84 (57.0)	1.33 (0.28-1.20)
Usual care participants	32 (11.4)	46 (16.0)	NA
OR for RAMP-HT achieving target	0.39 (0.01-1.60)	1.27 (1.23-1.30)	NA
TC (<4 mmol/L)			
RAMP-HT participants	75 (88.0)	80 (58.0)	1.32 (0.18-1.20)
Usual care participants	70 (23.4)	46 (15.4)	NA
OR for RAMP-HT achieving target	1.04 (0.1-1.40)	1.32 (1.26-1.39)	NA
HbA1c (<5.7)			
RAMP-HT participants	79 (56.7)	41 (27.2)	1.63 (0.96-1.03)
Usual care participants	79 (21.2)	42 (17.1)	NA
OR for RAMP-HT achieving target	1.86 (0.1-1.25)	1.35 (1.01-1.82)	NA
Nonlipidators			
RAMP-HT participants	95 (91.2)	101 (100.0)	1.38 (0.10-1.29)
Usual care participants	95 (84.2)	96 (87.4)	NA
OR for RAMP-HT achieving target	0.99 (0.34-1.03)	1.04 (1.00-1.08)	NA
Adjusted all targets			
RAMP-HT participants	13 (12.7)	47 (23.4)	1.38 (0.15-1.38)
Usual care participants	19 (22.6)	28 (33.3)	NA
OR for RAMP-HT achieving target	0.15 (0.05-0.88)	1.22 (1.26-1.19)	NA

^a JAMA Network Open. 2023;6(5):e2315064. doi:10.1001/jamanetworkopen.2023.15064

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Risk Assessment & Management of Hypertension (RAMP-HT)

Abbreviations: BMI, body mass index (calculated as weight in kilograms divided by height in meters squared); CVD, cardiovascular disease; CVD disease, blood pressure; FC, fasting glucose; LDL-C, low-density lipoprotein cholesterol; HDL-C, high-density lipoprotein cholesterol; HR, hazard ratio; HT, hypertension; HbA1c, glycated hemoglobin; TC, total cholesterol; US, United States. ^b OR were adjusted for the corresponding target of clinical outcome at baseline.

Table 3. Outcome Events at 5 Years in RAMP-HT Participants and Usual Care Patients

Event	RAMP-HT participants (n = 108-045) Cases with event, No. (%)	Incidence rate (cases/100 person-years) (95% CI)	Usual care patients (n = 104-662) Cases with event, No. (%)	Incidence rate (cases/100 person-years) (95% CI)	ARR, %	HR*	P value	NNT
All outcome event	12 796 (11.8)	1.1 (1.0-1.1)	27 514 (26.3)	5.4 (5.3-5.5)	34.3	0.58 (0.57-0.59)	<.001	11 (10-11)
CVD	9167 (8.5)	2.1 (2.1-2.2)	17 261 (16.5)	3.4 (3.3-3.4)	8.0	0.62 (0.61-0.64)	<.001	16 (15-16)
CHD	3964 (3.7)	0.9 (0.8-0.9)	6607 (6.3)	1.3 (1.3-1.3)	2.6	0.66 (0.63-0.69)	<.001	47 (44-51)
Heart failure	1799 (1.7)	0.4 (0.4-0.5)	5094 (4.9)	0.9 (0.9-0.9)	3.2	0.54 (0.51-0.58)	<.001	49 (46-52)
Stroke	4378 (4.1)	1.0 (1.0-1.0)	8467 (8.1)	1.6 (1.6-1.6)	4.0	0.64 (0.61-0.66)	<.001	36 (33-38)
ESKD	808 (0.7)	0.2 (0.2-0.2)	2409 (2.3)	0.4 (0.4-0.4)	1.6	0.54 (0.50-0.59)	<.001	106 (97-120)
Diabetes	10235 (9.5)	2.4 (2.4-2.5)	14 724 (14.1)	3.1 (3.1-3.2)	4.6	0.83 (0.80-0.85)	<.001	41 (36-48)
All-cause mortality	4833 (4.5)	1.2 (1.2-1.3)	15 144 (14.5)	2.9 (2.9-3.0)	10.9	0.51 (0.50-0.54)	<.001	17 (16-18)
CVD mortality	1532 (1.4)	0.4 (0.4-0.4)	576 (5.3)	1.0 (1.0-1.1)	3.9	0.51 (0.48-0.54)	<.001	43 (40-46)
Non-CVD mortality	3301 (3.1)	0.8 (0.8-0.8)	9568 (9.1)	1.8 (1.7-1.8)	6.0	0.54 (0.51-0.56)	<.001	45 (43-48)

Abbreviations: ARR, absolute risk reduction; CHD, coronary heart disease; CVD, cardiovascular disease; ESKD, end-stage kidney disease; HR, hazard ratio; NNT, number needed to treat; RAMP-HT, Risk Assessment and Management Program for Hypertension.

* Hazard ratios were adjusted by gender, age, smoking status, systolic blood pressure, diastolic blood pressure, fasting glucose, low-density lipoprotein cholesterol, TC/HDL-C ratio, triglyceride, body mass index, estimated glomerular filtration rate, Charlson Comorbidity Index and the usages of angiotensin converting enzyme inhibitor/angiotensin receptor blocker, β-blocker, calcium channel blocker, diuretic, other antihypertensive drugs, statin and fibrate at baseline.

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Effect of Obesity and Family history on BP

Obesity and HBP (BMI>30)

Age	% BMI>30 w HBP	%BMI>30 w/o HBP
18-35	67	38
35-50	71	52
50-75	58	50
>75	34	32
TOTAL	54	45



Blood pressures of Population

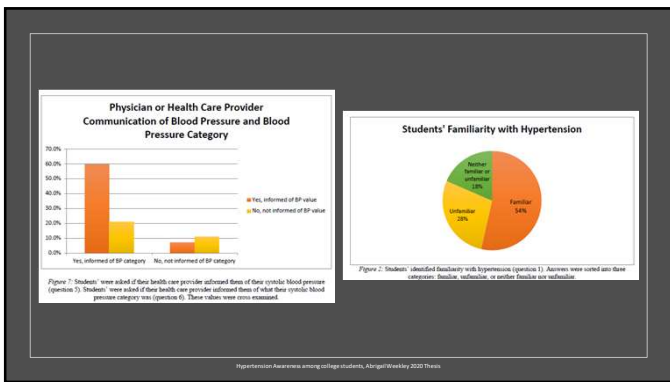
Those without hypertension

- 16% have a blood pressure greater than 140 mm
- 85% do not have a blood pressure recorded in 6 months
- 39% have a blood pressure <120

Those with hypertension

- 35% have blood pressure greater than 140 mm
- 25% do not have a blood pressure recorded in 6 months
- 18% have a blood pressure <120

Data from Central Illinois - EPIC



Hypertension, Risk Factors, and Education in Healthy College Students Over Time

52% of students had an elevated Systolic & 34% Had an elevated diastolic blood pressure

Significance of Problem: Hypertension (HTN) is a common condition, with a 1 in 10 adults having HTN. It is a leading cause of death and disability in the United States. HTN is a major risk factor for cardiovascular disease, stroke, and kidney disease. College students are not immune to HTN, and awareness of their hypertension status is low.

Purpose and Framework: The purpose of this study was to assess the prevalence of hypertension among college students and to determine the factors associated with hypertension. The framework for this study was based on the health belief model and the theory of planned behavior.

Sample Characteristics (Survey n=100):

Characteristic	Percentage (%)
Female	65%
Male	35%
Gender Fluid	0%
Age	19.2%
18-19	10%
20-29	70%
30-39	15%
40-49	5%
50-59	3%
60-69	2%
70-79	1%
80-89	1%
90-99	0%

Stressful Life Events: Number of events (M=2.85, SD=1.06, range=0-16)

Event	Percentage (%)
High Stressful Events	21.2%
Low Stressful Events	78.8%

Stress-Relieving Habits that Affect BP:

Habit	Percentage (%)
Smoking	3.0%
Drinking	1.0%
Exercise	1.0%
Relaxation	1.0%
Other	1.0%

Conclusions: This study found that hypertension is a common condition among college students. The prevalence of hypertension was higher among students with high stress levels and those who did not exercise regularly. The findings suggest that interventions aimed at reducing stress and promoting regular exercise may help to reduce the prevalence of hypertension among college students.

Recommendations: College students should be encouraged to get regular medical checkups to monitor their blood pressure. They should also be encouraged to adopt healthy lifestyle habits, such as regular exercise, a balanced diet, and stress management techniques.

**Effects of Cuff Size on the Accuracy of Blood Pressure Readings
The Cuff(SZ) Randomized Crossover Trial**

Junho Shimizu, MD, MPH¹; Jeanne Charleston, RN²; Edgar R. Miller III, MD, PhD^{1,2}; et al.;¹Junhiro Matsubara, MD, PhD^{1,2}; Lawrence J. Appel, MD, MPH^{1,2}; Tammy M. Brady, MD, PhD¹
Author Affiliations:
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- **Results** A total of 195 adults (mean [SD] age, 54 [16] years; 67 [34%] male; 132 [68%] Black; 100 [51%] with hypertension) were randomized for inclusion. Among individuals requiring a small BP cuff, use of a regular BP cuff resulted in a statistically significant lower BP reading (mean systolic BP difference, -3.6 [95% CI, -5.6 to -1.7] mm Hg). In contrast, among individuals requiring a large or extra-large BP cuff, use of a regular BP cuff resulted in a statistically significant higher BP reading (mean systolic BP difference, 4.8 [95% CI, 3.0-6.6] mm Hg and 19.5 [95% CI, 16.1-22.9] mm Hg, respectively). For the secondary outcome, BP differences with overcuffing and undercuffing by 1 and 2 cuff sizes were greater among those requiring larger BP cuffs. The results were consistent in stratified analyses by systolic BP and body mass index.
- **Conclusions and Relevance** In this randomized crossover trial, miscuffing resulted in strikingly inaccurate BP measurements. This is particularly concerning for settings where 1 regular BP cuff size is routinely used in all individuals, regardless of arm size. A renewed emphasis on individualized BP cuff selection is warranted.

Taking a Proper BP

- Sit quietly 5 minutes
- Cuff should cover 80% of upper arm on bare skin
- At least 1 time have BP checked in both arms
- Sit with both feet on floor, elbow at heart level
- Use bell of stethoscope



Use of Out of Office BP Monitoring



RULE OUT "WHITE COAT" EFFECT



MASKED HYPERTENSION



NOCTURNAL HYPERTENSION



EVALUATION OF COMPLEXED DRUG REGIMEN

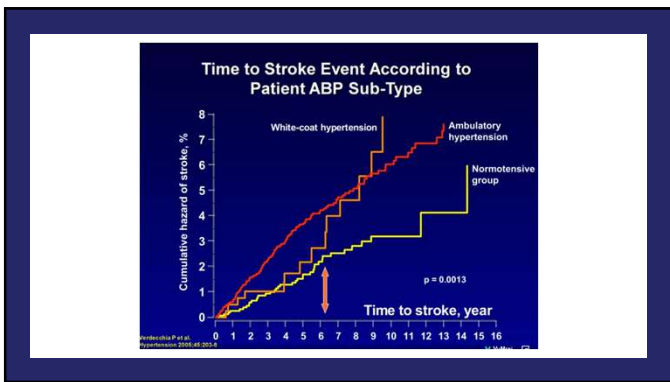


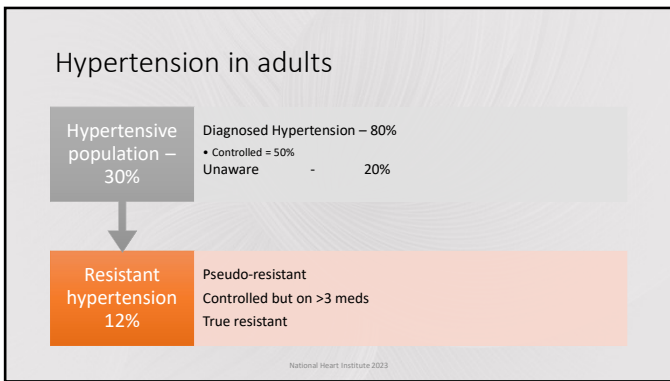
VARIABLE BP MEASUREMENTS

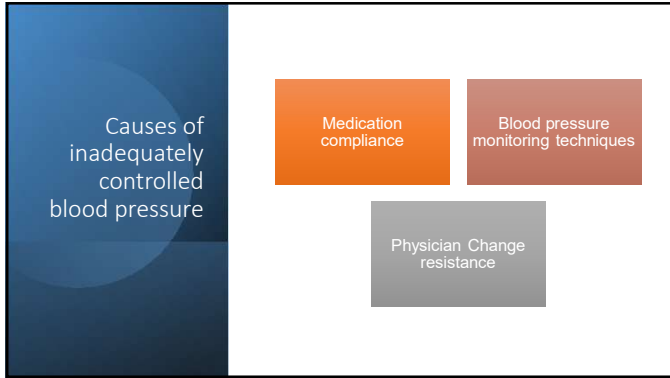
Canadian BedMed Trial

- NO difference between AM and HS dosing
 - Hospitalizations for MI & CVA or CHF
 - Vascular death
 - All-cause death

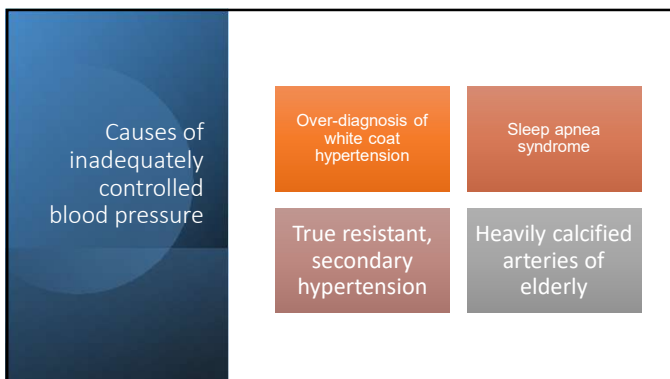
BMI (22) Feb 24; 12(2)





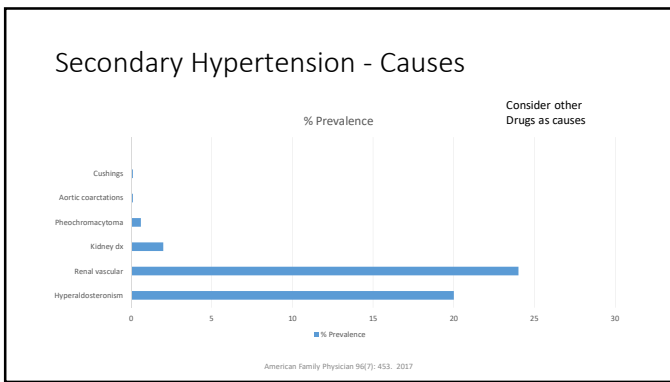






When to look for Secondary Hypertension

- Drug resistant to 4 drugs
- Abrupt onset of hypertension
- Onset < 30 years
- Exacerbation of controlled hypertension
- Malignant hypertension
- Onset of diastolic hypertension >65 years
- Unprovoked or excessive hypokalemia



Pseudo-resistance detection

Recheck	Recheck BP – proper technique
Exclude	Exclude white coat
Count	Count pills
Drug	Drug tests

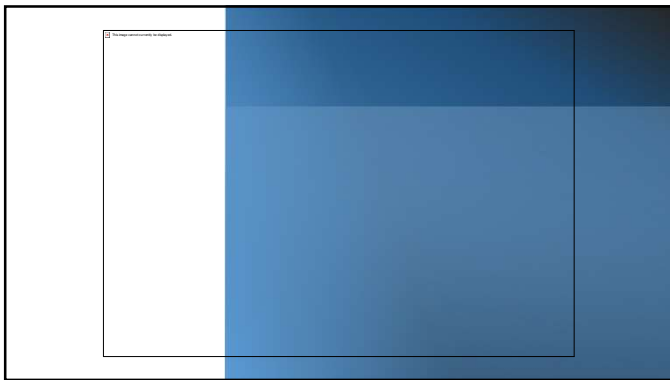
Evaluation for rHTN

Meds that interfere or cause HTN

- NSAIDS, cold meds, Oral contraceptives, herbals, street drugs

Life style

- Sodium
- ETOH
- Water consumption



rHTN - Summary

Make sure of diagnosis


Maximize dosing of ACE/ARB, Thiazide, CCB

Spironolactone should be 4th drug

New drugs are coming

Clinical Clues to Hyperaldosteronism

Maybe	Poor BP control Low potassium – 45% Metabolic alkalosis
Probably no	Edema
Represents about 11% of resistant aldosteronism	



Renal Artery Stenosis

Hypertensive population 5 %

Autopsy

- <5% under 64
- 18% 65-74
- 42% >75

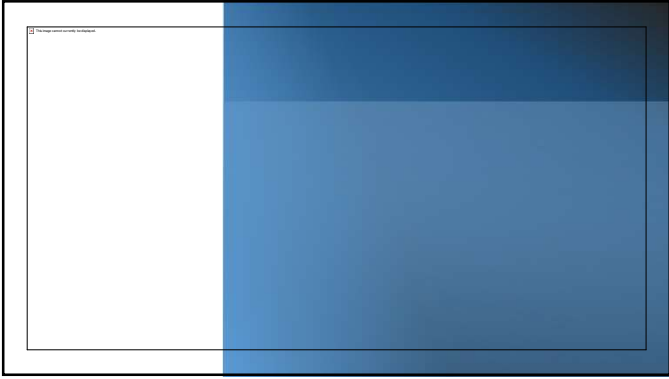
Most common cause of resistant HTN is Primary Hypertension

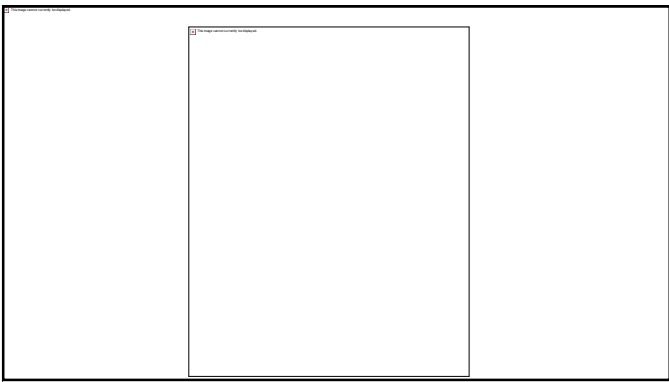
Planks of a Successful Campaign (AMGA)

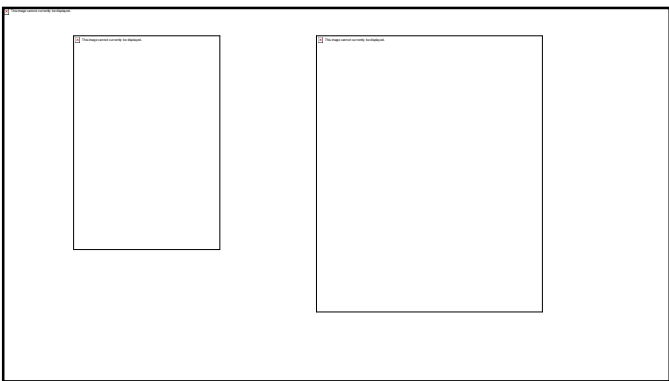
- ✓ Registry of patients with hypertension
- ✓ Training in correct way to check blood pressure
- ✓ Address blood pressure at every primary care visit
- ✓ All patients not at goal seen within 30 days
- ✓ Hypertension treatment guidelines
- ✓ Address blood pressure at specialist visits
- ✓ Education to staff and public on the importance of control

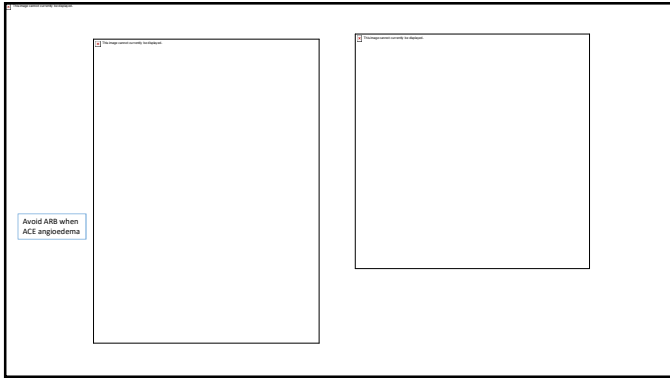
Other Hypertension Initiatives

- ACO Nurse
- PHCM example: Pharmacist protocol
- Health Coach or Case Management
- Resistant Hypertension Clinic development
- Research study regarding young females (FLYER)
- Research study with University of Iowa & NIH (CVRS Live)
- HTN prevention using predictive modeling
- Physician Best Practice Committee & Quality discussions

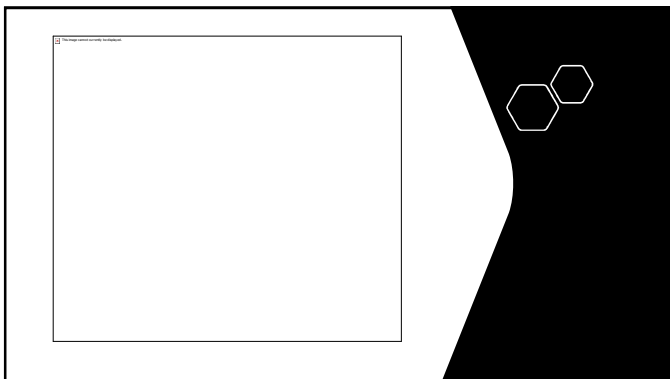












Diagnostics that need to have been done

Labs	Other diagnostics
• CMP	• EKG
• CBC	• Ambulatory BP monitor
• Ua	• 10 year risk calculation (ACC 2019)
• TSH	• STOP-BANG
• Lipid	• BMP

Hypertension in Stage 3b/4 CKD

75 y/o male – 20 yrs HBP & 10 yrs CKD with GFR 30, T2DM w/ microalb. SBP=160. Meds=Lisinopril/HCT 20/25+Amlopidine 10 mg.

Options

β Blocker (block low BS, bradycardia)	Hydralazine (short term effect, multiple daily doses, multiple SE)	Alpha blockers (ineffective)	Minoxidil (fluid retention, hirsutism)	Spirolactone & Eplerenone (high potassium)	Finerenone – ineffective
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