HYPERTENSION

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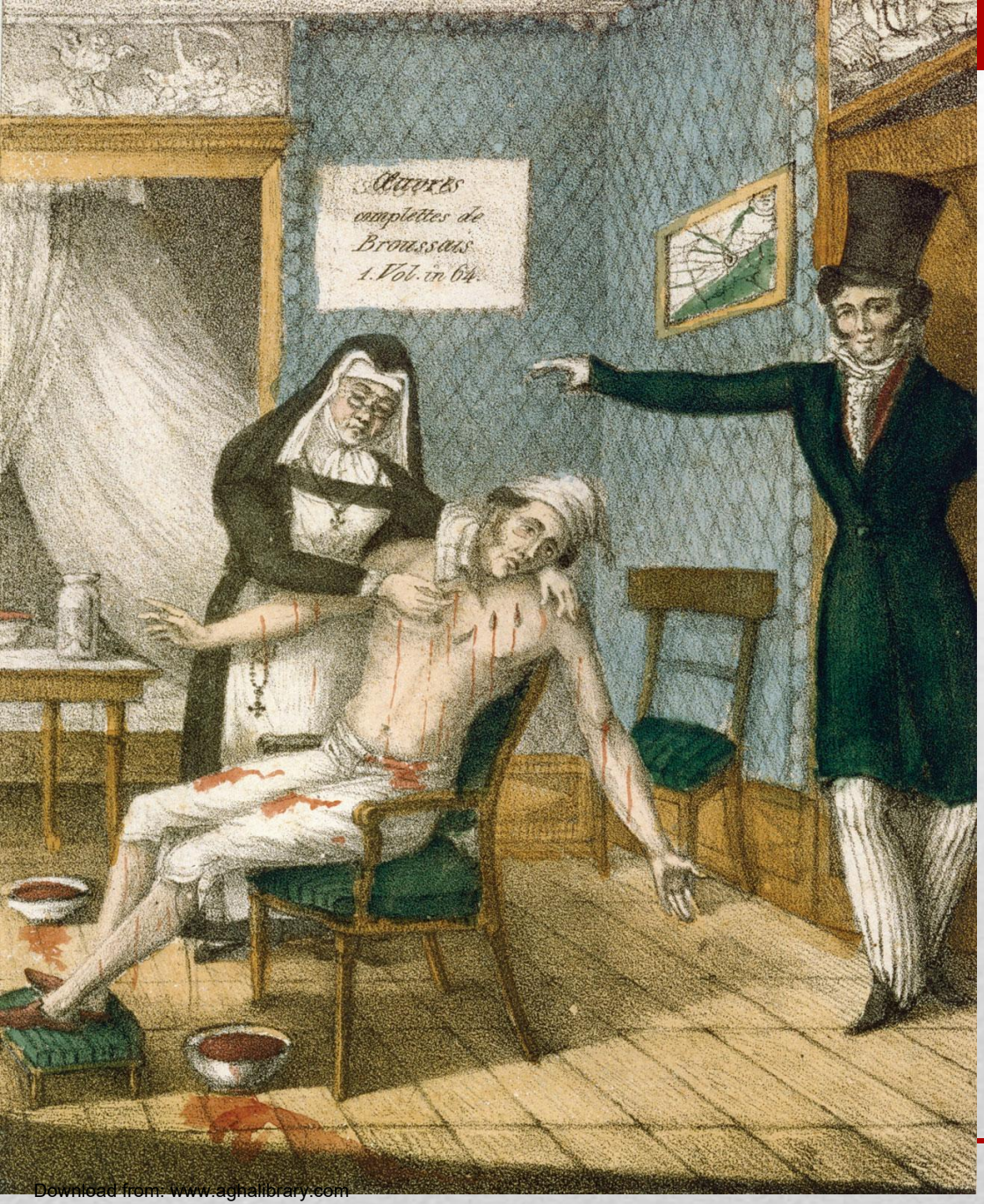
History of Hypertension

History of Hypertension

- Historical records as far back as 2600 B.C. hold mention of “hard pulse disease”
- First treatments: Leeching/phlebotomy, acupuncture
- Hippocrates recommended phlebotomy
- 120 AD – cupping of the spine to draw animal spirits down and out was recommended



Lithograph showing the leeching of a patient, date unknown.
National Library of Medicine, Bethesda, Maryland

Measurement of HTN

- No way to measure prior to 1700s
  - Physicians could estimate by feeling pulse

Measurement of HTN

- 1733 – Reverend Stephen Hales measured the intra-arterial BP of a horse

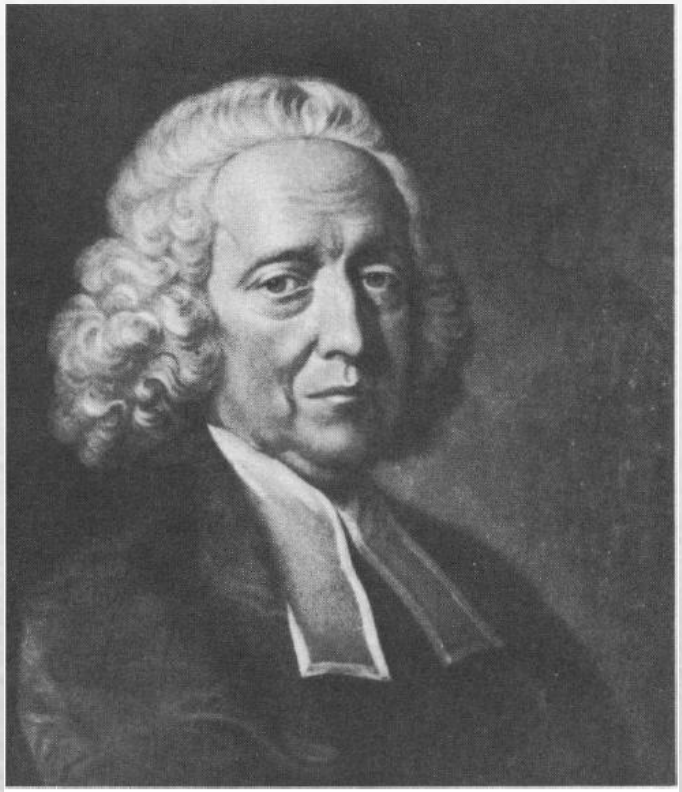
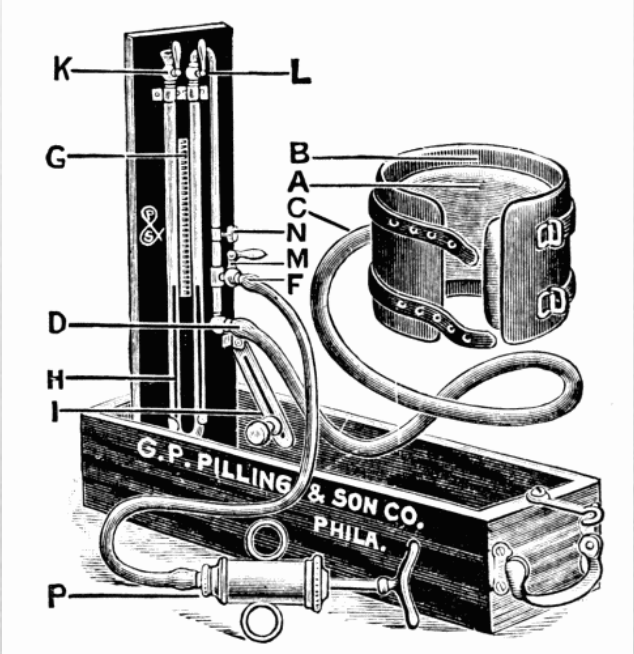


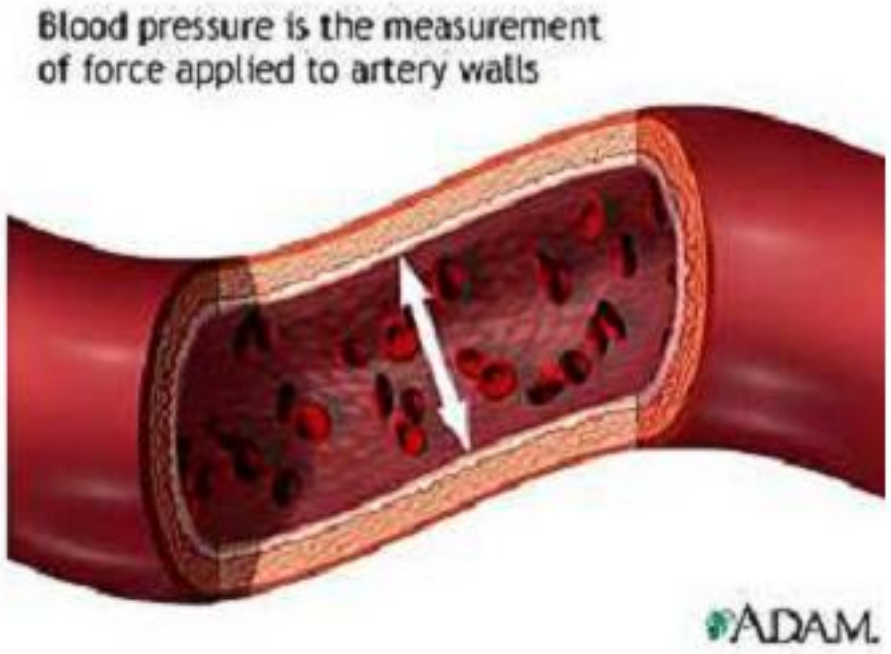
Fig 1 *Stephen Hales (1677–1761) (by courtesy of the Wellcome Trustees)*

- 1905 – N.C. Korotkoff reported on the method of auscultation of brachial artery, the method which is widely used today
  - Allowed auscultation of diastolic BP as well



Blood pressure

- is the amount of force on the walls of the arteries as the blood circulates around the body.

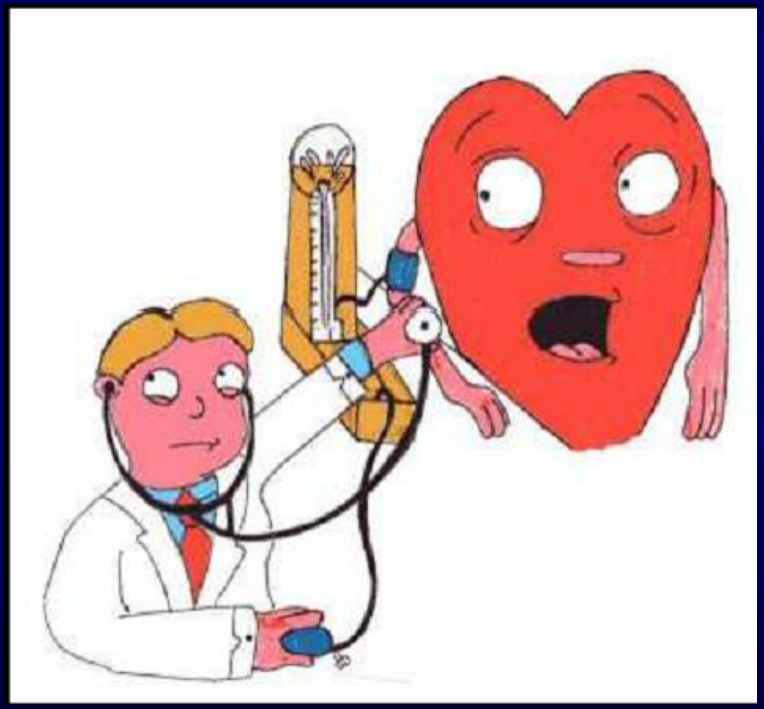


Factors Influencing Blood Pressure

Blood Pressure = **Cardiac Output** x **Systemic Vascular Resistance**

Factors Influencing BP

- HR
- SNS/PNS
- Vasoconstriction/vasodilation
- Fluid volume
  - Renin-angiotensin
  - Aldosterone
  - ADH



Hypertension

Definition

- Hypertension is sustained elevation of BP
  - Systolic blood pressure ≥ 140 mm Hg
  - Diastolic blood pressure ≥ 90 mm Hg

Classification (JNC7)	Systolic pressure	Diastolic pressure
	mmHg	mmHg
Normal	90–119	60–79
High normal or prehypertension	120–139	80–89
Stage 1 hypertension	140–159	90–99
Stage 2 hypertension	≥160	≥100
Isolated systolic hypertension	≥140	<90

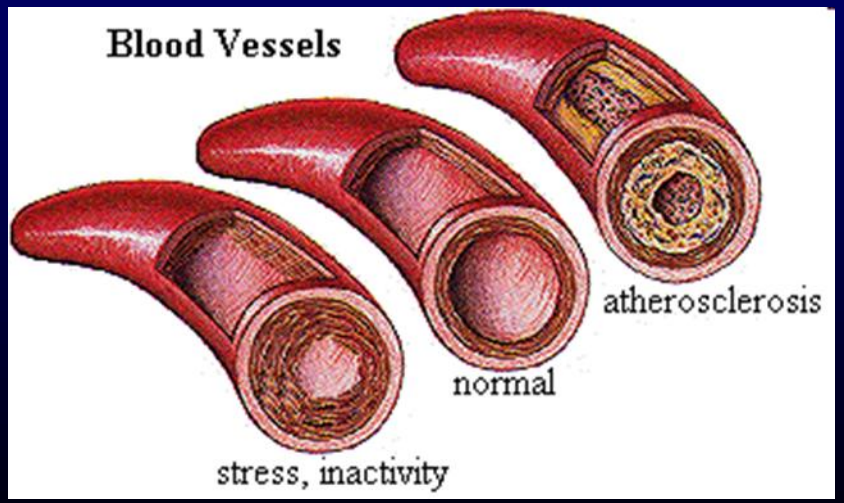
Accurate BP measurement

- Who checks your patients BP?
  - You or Staff
    - IF Staff – Do they know what to listen for or do they use automated equipment
  - Seated quietly for 5 minutes
  - Appropriate size cuff
  - Inflate 20-30 mmHg above loss of radial pulse
  - Deflate at 2mmHg per second
  - 1st sound SBP ; Disappearance of Korotkoff sound (phase 5) is DBP
  - Confirm Elevated blood pressure within 2months(stage 1) – shorter for stage 2 if new onset

Hypertension

- For persons over age 50, SBP is more important than DBP as a CVD risk factor

- Starting at 115/75 mmHg, CVD risk doubles with each increment of 20/10 mmHg throughout the BP range



Classification of Hypertension

- **Primary (Essential) Hypertension**
  - **Elevated BP with unknown cause**
  - **90% to 95% of all cases**
- **Secondary Hypertension**
  - **Elevated BP with a specific cause**
  - **5% to 10% in adults**

Classification of Hypertension

- **Primary Hypertension**
  - **Contributing factors:**
    - **↑ SNS activity**
    - **Diabetes mellitus**
    - **↑ Sodium intake**
    - **Excessive alcohol intake**

Classification of Hypertension

- **Secondary Hypertension**
  - **Contributing factors:**
    - **Coarctation of aorta**
    - **Renal disease**
    - **Endocrine disorders**
    - **Neurologic disorders**
  - **Rx: Treat underlying cause**

Risk Factors for Primary Hypertension

- Age (> 55 for men; > 65 for women)
- Alcohol
- Cigarette smoking
- Diabetes mellitus
- Elevated serum lipids
- Excess dietary sodium
- Gender

Risk Factors for Primary Hypertension

- Family history
- Obesity (BMI $\geq$ 30)
- Ethnicity (African Americans)
- Sedentary lifestyle
- Socioeconomic status
- Stress

Hypertension
Clinical Manifestations

- **Frequently asymptomatic until severe and target organ disease has occurred**
  - **Fatigue, reduced activity tolerance**
  - **Dizziness**
  - **Palpitations, angina**
  - **Dyspnea**

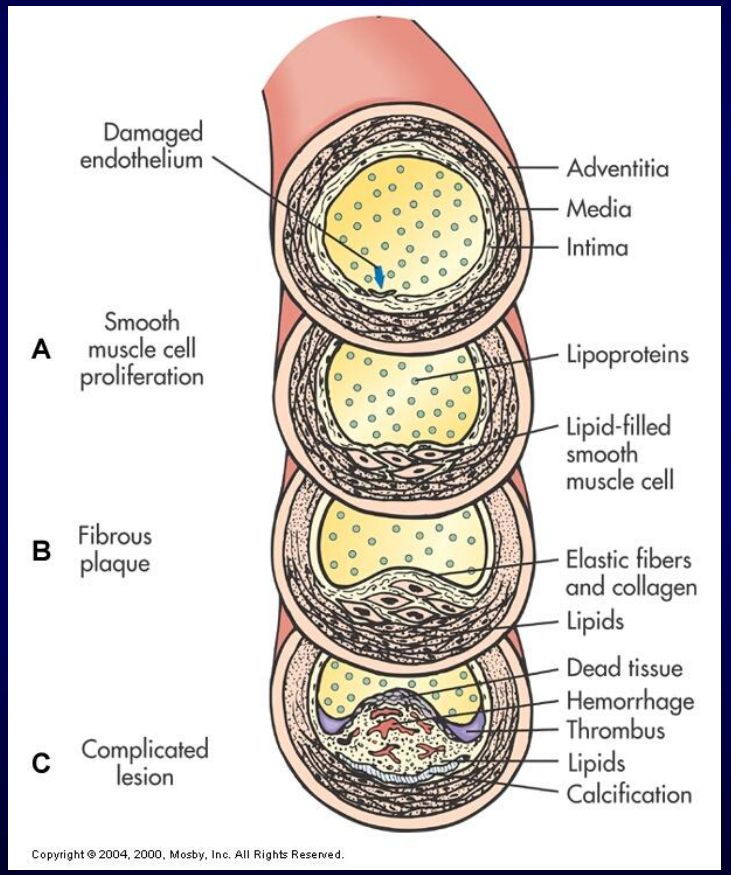
How to Prevent HTN

Lifestyle modifications prevent HTN and include:

- Maintaining a Healthy Weight
- Reduce Salt/Sodium Intake
- Increase Physical Exercise
- Smoking Cessation
- Limit Alcohol Consumption
- Limit Fat Intake
- Control Diabetes
- Stress Relieving Techniques

Hypertension: Complications

- Complications are primarily related to development of atherosclerosis (“hardening of arteries”), or fatty deposits that harden with age



Hypertension
Complications

The common complications are target organ diseases occurring in the

- **Heart**
- **Brain**
- **Kidney**
- **Eyes**

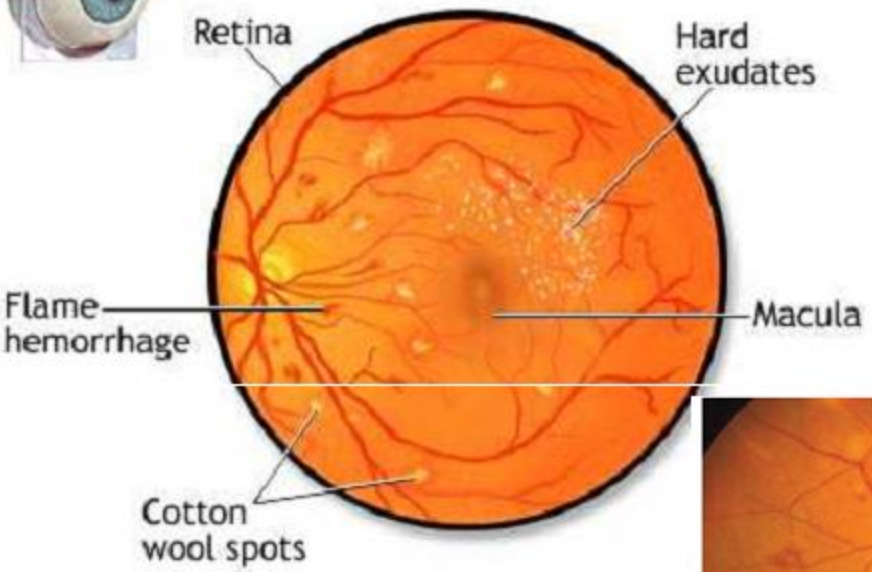
Hypertension
Complications

- **Hypertensive Heart Disease**
  - **Coronary artery disease**
  - **Left ventricular hypertrophy**
  - **Heart failure**

Hypertension
Complications

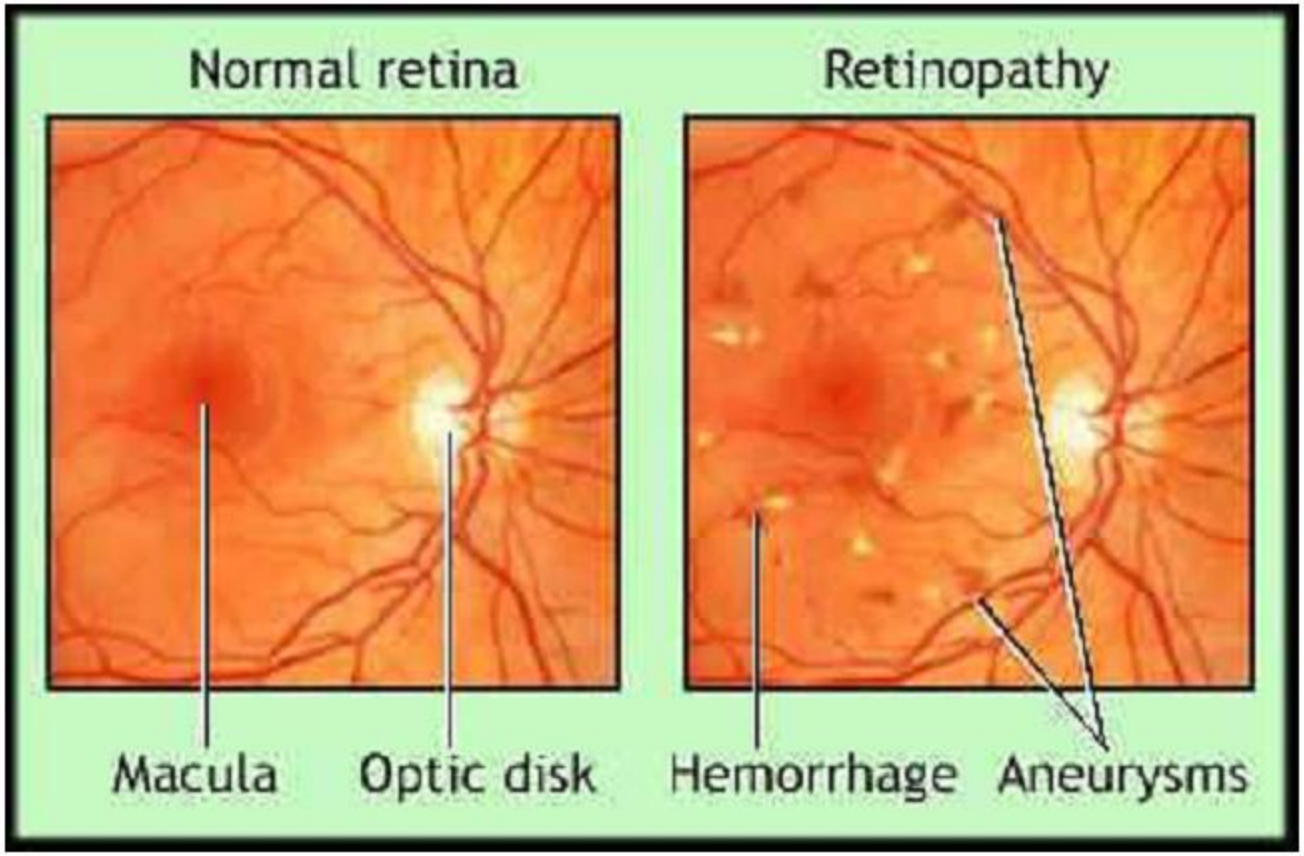
- Cerebrovascular Disease
  - Stroke
- Peripheral Vascular Disease
- Nephrosclerosis
- Retinal Damage

Hypertension can cause damage to the retina of the eye

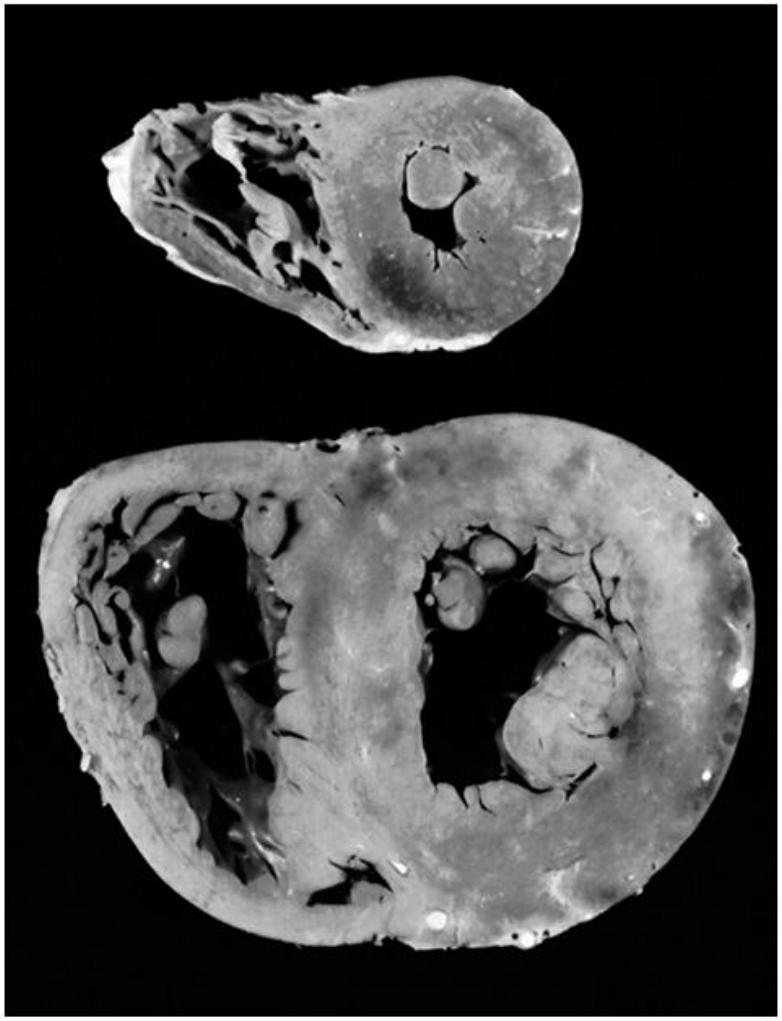


©ISM/ Rhoticke

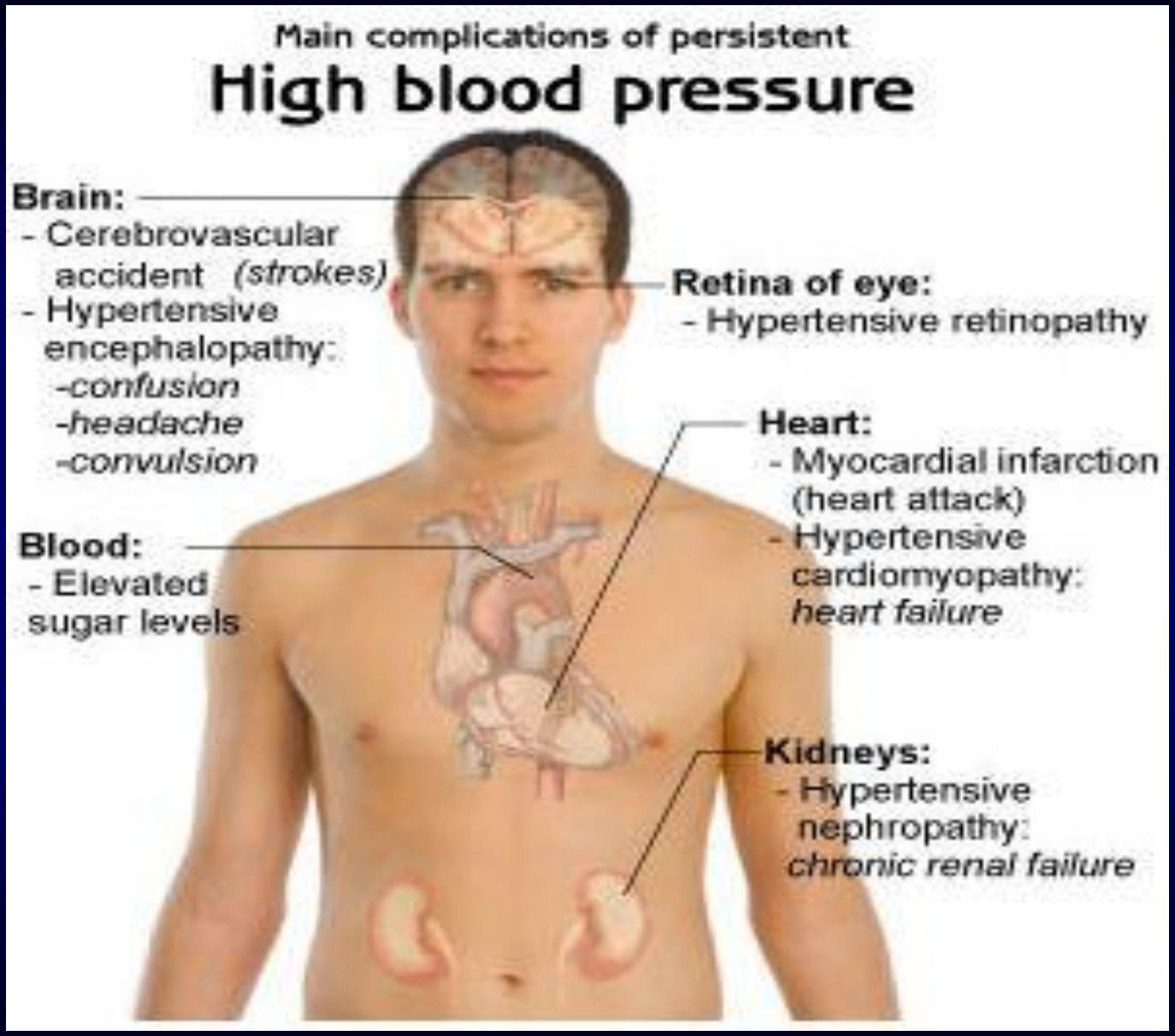
A fundus view of hypertensive retinopathy in the right eye shows hemorrhages and exudates caused by hypertension.



Left Ventricular Hypertrophy



From Kissane JM: *Anderson's pathology*, ed 9, St. Louis, 1990, Mosby.



TO SUMMARISE

Hypertension
Diagnosis

- Diagnosis requires several elevated readings over several weeks (unless $\geq$ 180/110)
- BP measurement in both arms
  - Use arm with higher reading for subsequent measurements

Hypertension
Diagnosis

- Ambulatory BP Monitoring
  - For “white coat” phenomenon, hypotensive or hypertensive episodes, apparent drug resistance

Treatment Goals

- **Goal is to reduce overall cardiovascular risk factors and control BP by the least intrusive means possible**
  - **BP < 140/90**
  - **In patients with diabetes or renal disease, goal is < 130/80**

Benefits of Lowering BP

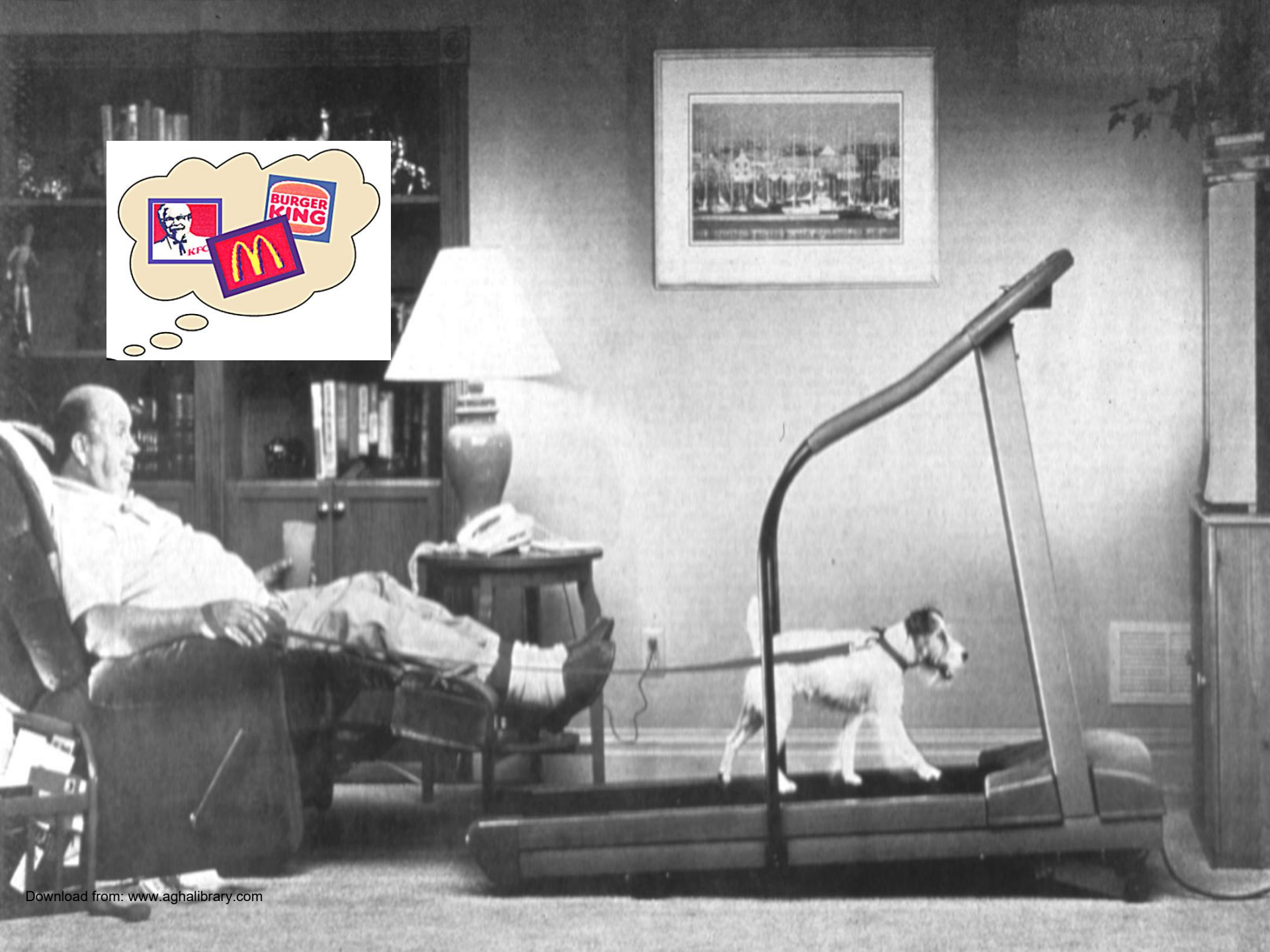
	Average Percent Reduction
Stroke incidence	35–40%
Myocardial infarction	20–25%
Heart failure	50%

Table 3. Lifestyle Modifications to Manage Hypertension*

Modification	Recommendation	Approximate Systolic BP Reduction, Range
Weight reduction	Maintain normal body weight (BMI, 18.5-24.9)	5-20 mm Hg/10-kg weight loss[23,24]
Adopt DASH eating plan	Consume a diet rich in fruits, vegetables, and low-fat dairy products with a reduced content of saturated and total fat	8-14 mm Hg[25,26]
Dietary sodium reduction	Reduce dietary sodium intake to no more than 100 mEq/L (2.4 g sodium or 6 g sodium chloride)	2-8 mm Hg[25-27]
Physical activity	Engage in regular aerobic physical activity such as brisk walking (at least 30 minutes per day, most days of the week)	4-9 mm Hg[28,29]
Moderation of alcohol consumption	Limit consumption to no more than 2 drinks per day (1 oz or 30 mL ethanol [eg, 24 oz beer, 10 oz wine, or 3 oz 80-proof whiskey]) in most men and no more than 1 drink per day in women and lighter-weight persons	2-4 mm Hg[30]

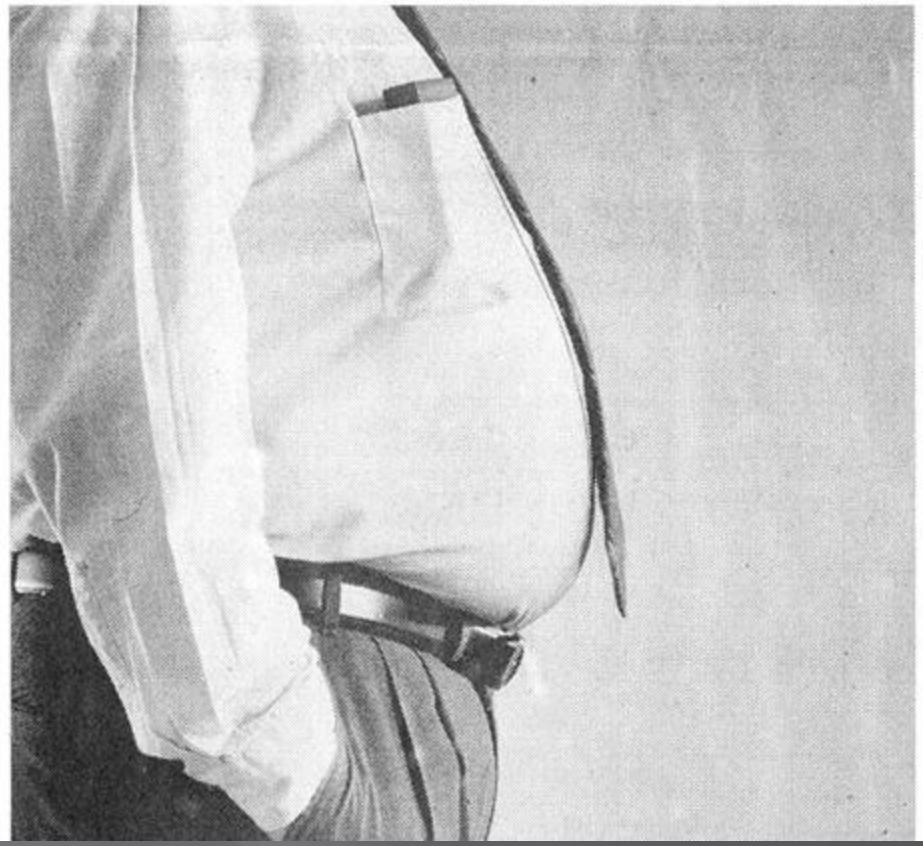
Abbreviations: BMI, body mass index calculated as weight in kilograms divided by the square of height in meters; BP, blood pressure; DASH, Dietary Approaches to Stop Hypertension.

*For overall cardiovascular risk reduction, stop smoking. The effects of implementing these modifications are dose and time dependent and could be higher for some individuals.

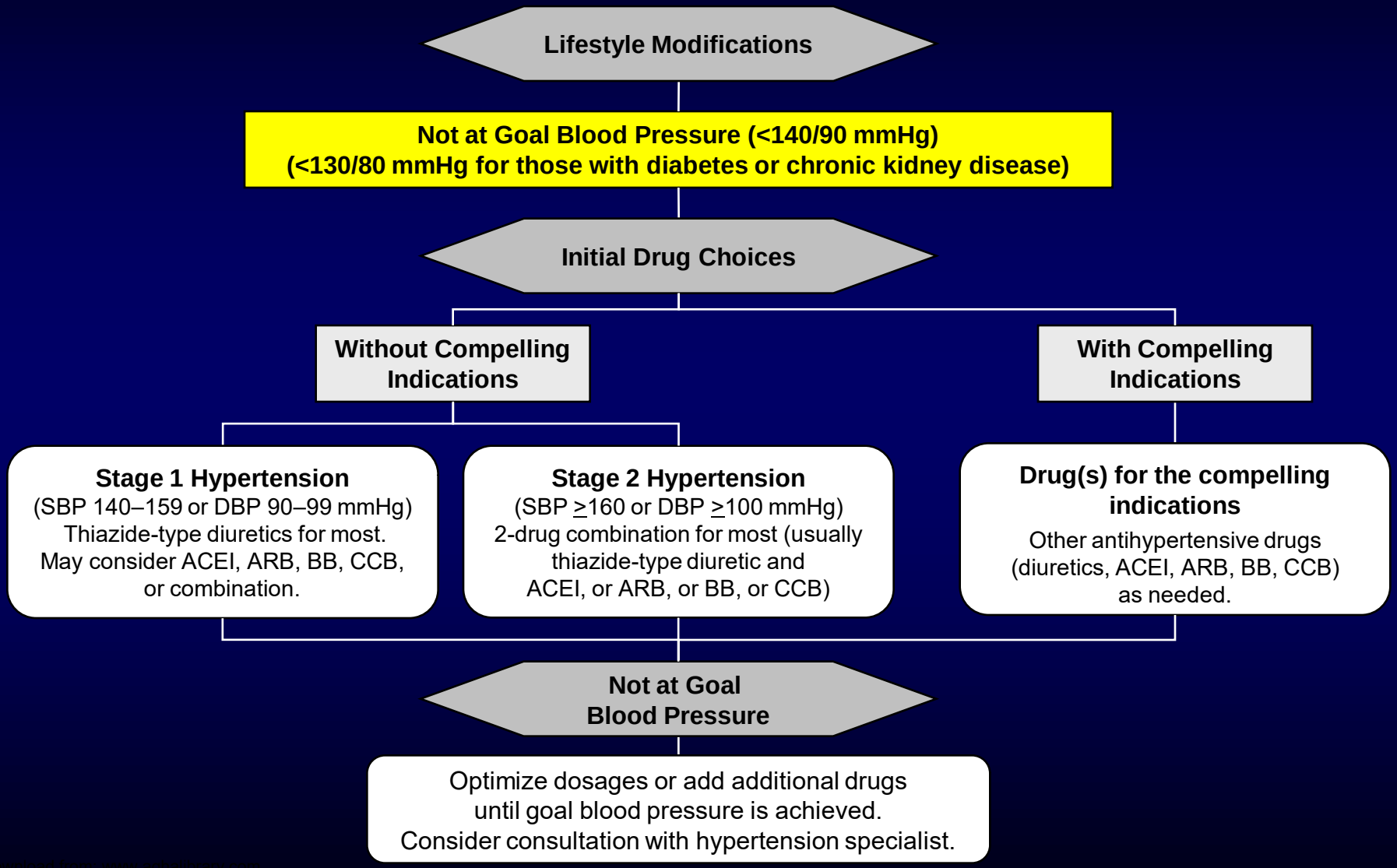


There's no such thing as a sudden heart attack.

It requires years of preparation.



Algorithm for Treatment of Hypertension



Hypertension
Collaborative Care

- **Lifestyle Modifications**

  - **Weight reduction**
  - **Dietary changes (DASH diet)**
  - **Limitation of alcohol intake ($\leq$ 2 drinks/day for men; $\leq$ 1/day for women)**
  - **Regular physical activity**
  - **Avoidance of tobacco use**
  - **Stress management**

Hypertension
Collaborative Care

- Nutritional Therapy: DASH Diet = Dietary Approahes to Stop HTN
  - Sodium restriction
  - Rich in vegetables, fruit, and nonfat dairy products
  - Calorie restriction if overweight

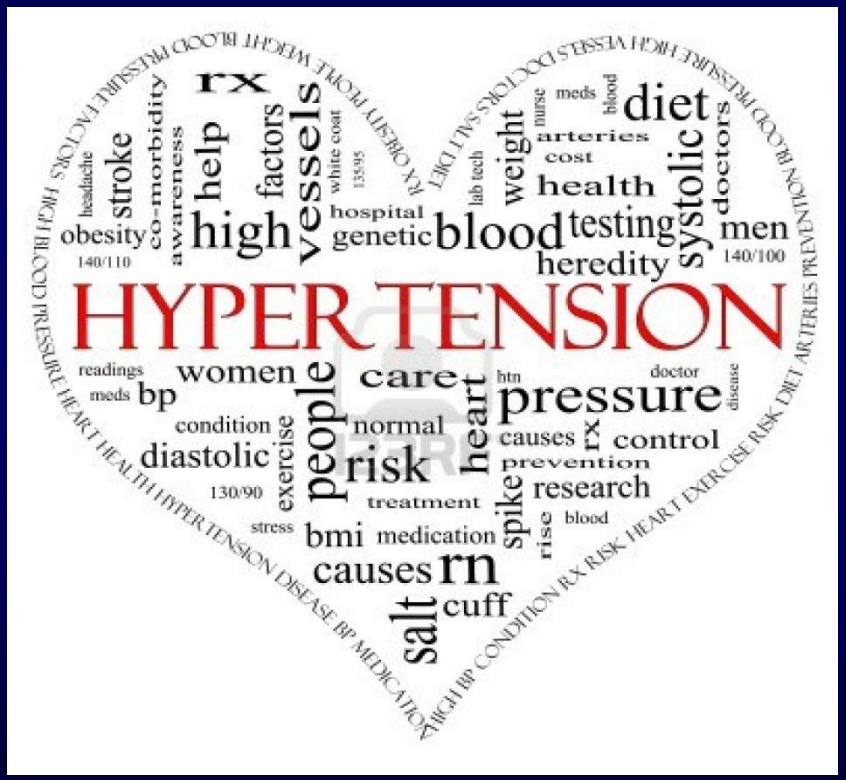
Follow the DASH diet to potentially lower your blood pressure.

DASH diet
(Dietary Approaches to Stop Hypertension)

FOOD GROUP	NO. SERVINGS PER DAY
Grains	7 – 8
Vegetables	4 – 5
Fruits	4 – 5
Low fat dairy foods	2 – 3
Meat, fish, poultry	2 or less
Nut, seeds, dry beans	4 – 5 weekly

Hypertension
Collaborative Care

- **Drug Therapy**
  - **Reduce SVR**
  - **Decrease volume of circulating blood**



Hypertension
Collaborative Care

- **Drug Therapy**
  - **Diuretics**
  - **Adrenergic inhibitors**
  - **β - Adrenergic blockers**
  - **ACE Inhibitors**
  - **Calcium channel blockers**

TABLE I. Drug Selection in Hypertensive Patients With or Without Other Major Conditions

Patient Type	First Drug	Add Second Drug If Needed to Achieve a BP <140/90 mm Hg	If Third Drug is Needed to Achieve a BP of <140/90 mm Hg
A. When hypertension is the only or main condition			
Black patients (African ancestry): All ages	CCB[a] or thiazide diuretic	ARB[b] or ACE inhibitor (If unavailable can add alternative first drug choice)	Combination of CCB + ACE inhibitor or ARB + thiazide diuretic
White and other non-black Patients: Younger than 60	ARB[b] or ACE inhibitor	CCB[a] or thiazide diuretic	Combination of CCB + ACE inhibitor or ARB + thiazide diuretic
White and other non-black patients: 60 y and older	CCB[a] or thiazide diuretic (Although ACE inhibitors or ARBs are also usually effective)	ARB[b] or ACE inhibitor (or CCB or thiazide if ACE inhibitor or ARB used first)	Combination of CCB + ACE inhibitor or ARB + thiazide diuretic

Abbreviations: ACE, angiotensin-converting enzyme; ARB, angiotensin receptor blocker; BP, blood pressure; CCB, calcium channel blocker; eGFR, estimated glomerular filtration rate.

B. When hypertension is associated with other conditions

Hypertension *and* diabetes	ARB or ACE inhibitor Note: in black patients, it is acceptable to start with a CCB or thiazide	CCB or thiazide diuretic Note: in black patients, if starting with a CCB or thiazide, add an ARB or ACE inhibitor	The alternative second drug (thiazide or CCB)
Hypertension *and* chronic kidney disease	ARB or ACE inhibitor Note: in black patients, good evidence for renal protective effects of ACE inhibitors	CCB or thiazide diuretic[c]	The alternative second drug (thiazide or CCB)
Hypertension *and* clinical coronary artery disease[d]	β-Blocker plus ARB or ACE inhibitor	CCB or thiazide diuretic	The alternative second step drug (thiazide or CCB)
Hypertension *and* stroke history[e]	ACE inhibitor or ARB	Thiazide diuretic or CCB	The alternative second drug (CCB or thiazide)
Hypertension and heart failure	Patients with symptomatic heart failure should usually receive an ARB or ACE inhibitor + β-blocker + diuretic + spironolactone regardless of blood pressure. A dihydropyridine CCB can be added if needed for BP control.		

Abbreviations: ACE, angiotensin-converting enzyme; ARB, angiotensin receptor blocker; BP, blood pressure; CCB, calcium channel blocker; eGFR, estimated glomerular filtration rate.

Hypertension: Drug Therapy

- Thiazide-type Diuretics
  - Inhibit NaCl reabsorption
  - Side effects:
    - Electrolyte imbalances: ↓ Na, ↓ Cl, ↓ K** (advise K rich foods)
    - Fluid volume depletion (monitor for orthostatic hypotension)
    - Impotence, decreased libido

Hypertension: Drug Therapy

- Adrenergic Inhibitors
  - Reduce sympathetic effects that cause HTN by:
    - Reducing sympathetic outflow
    - Blocking effects of sympathetic activity on vessels
  - Side effects
    - Hypotension
    - Varied, depending on specific drug

Hypertension: Drug Therapy

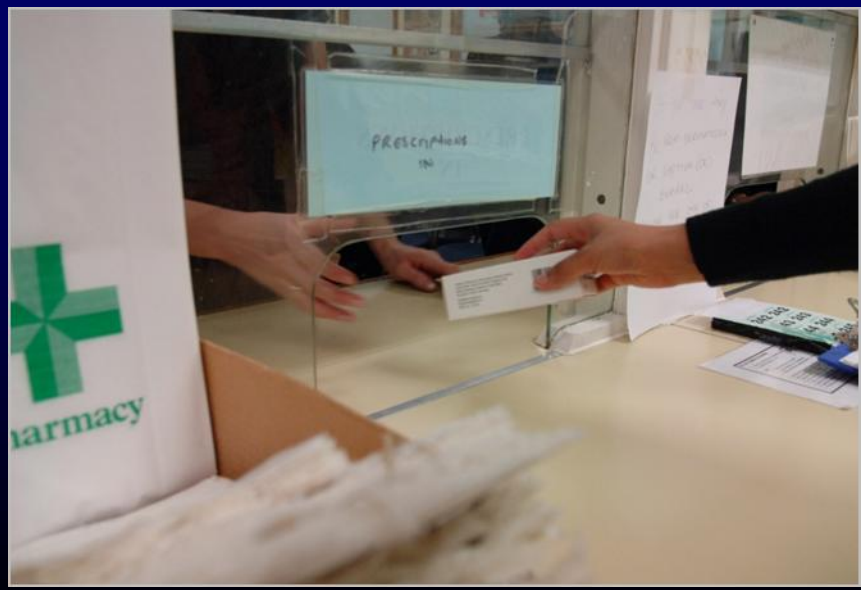
- β – adrenergic blockers (suffix “olol”)
  - (metoprolol, propranolol)
  - Block β – adrenergic receptors
    - ↓ HR, ↓ inotropy, reduces sympathetic vasoconstriction)
  - Side effects
    - Bradycardia, hypotension, heart failure, impotence

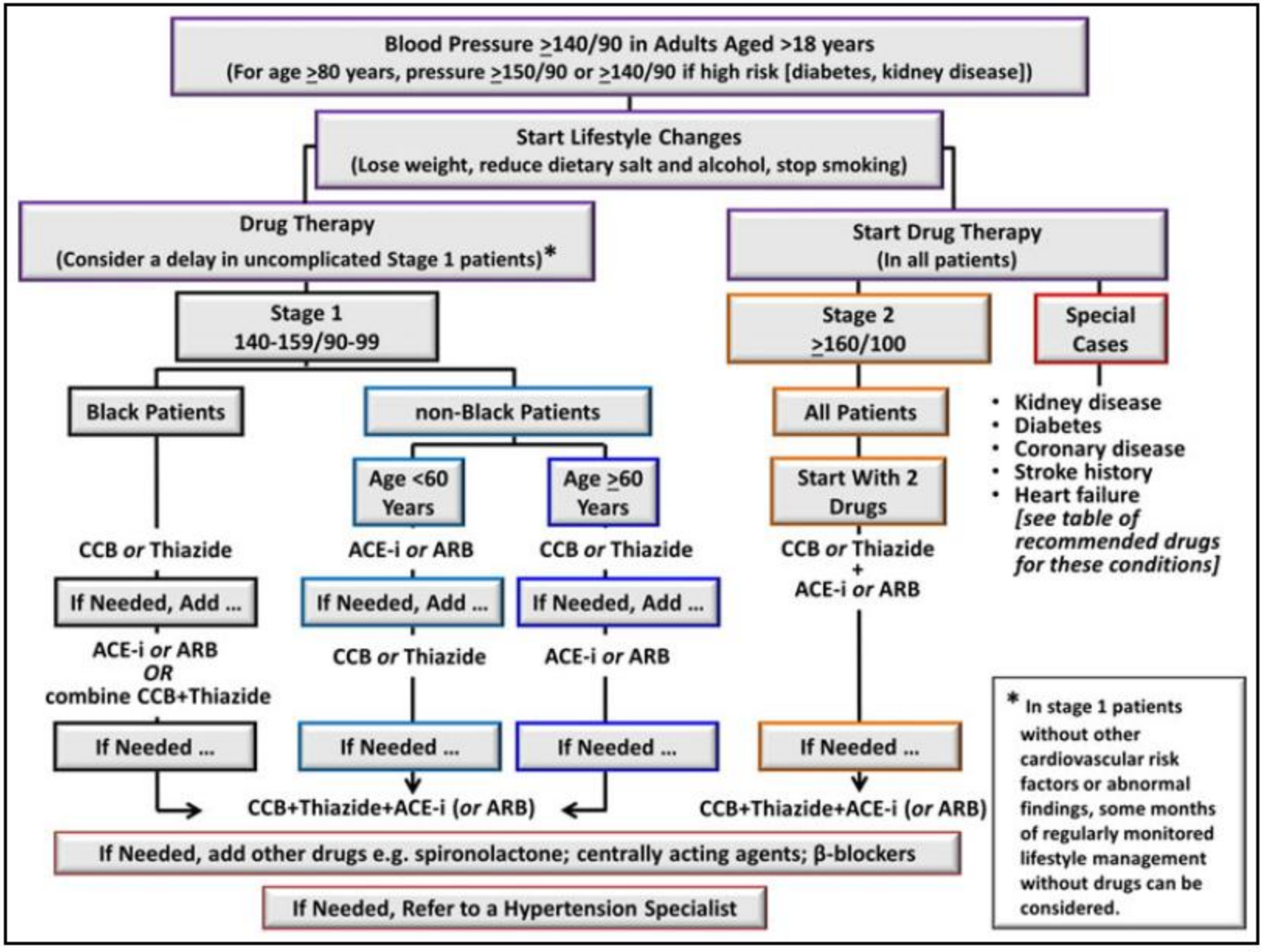
Hypertension: Drug Therapy

- ACE Inhibitors (suffix “pril)
  - Enalapril, captopril
  - Prevents conversion of angiotensin I to angiotensin II, thereby preventing the vasoconstriction associate with A II.
  - Side effects
    - Hypotension, cough

Hypertension: Drug Therapy

- Calcium Channel Blockers
  - Block movement of calcium into cells, causing vasodilation
  - Side effects
    - Brdaycardia, heart block





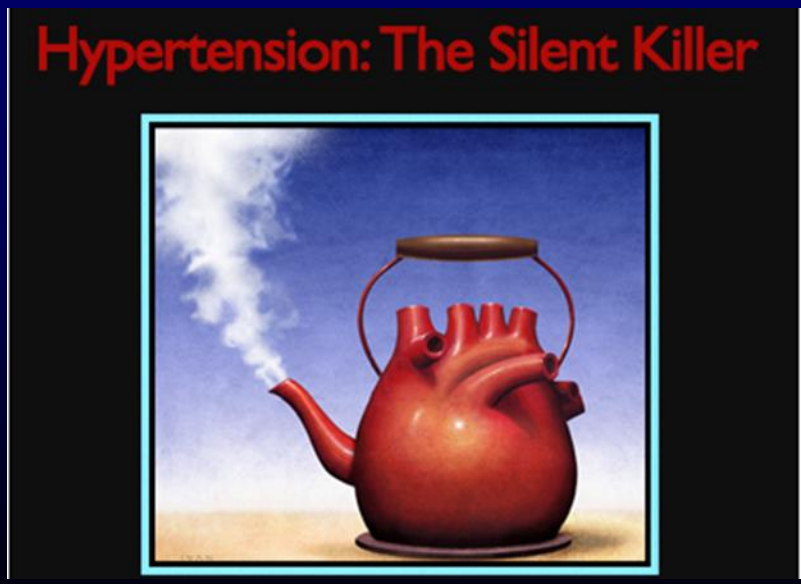
ASH/ISH HTN Guidelines 2014

Table 6. Guideline Comparisons of Goal BP and Initial Drug Therapy for Adults With Hypertension

Guideline	Population	Goal BP, mm Hg	Initial Drug Treatment Options
2014 Hypertension guideline	General ≥60 y	<150/90	Nonblack: thiazide-type diuretic, ACEI, ARB, or CCB
	General <60 y	<140/90	Black: thiazide-type diuretic or CCB
	Diabetes	<140/90	Thiazide-type diuretic, ACEI, ARB, or CCB
	CKD	<140/90	ACEI or ARB
ESH/ESC 2013[37]	General nonelderly	<140/90	β-Blocker, diuretic, CCB, ACEI, or ARB
	General elderly <80 y	<150/90	
	General ≥80 y	<150/90	
	Diabetes	<140/85	ACEI or ARB
	CKD no proteinuria	<140/90	ACEI or ARB
	CKD + proteinuria	<130/90	
CHEP 2013[38]	General <80 y	<140/90	Thiazide, β-blocker (age <60y), ACEI (nonblack), or ARB
	General ≥80 y	<150/90	
	Diabetes	<130/80	ACEI or ARB with additional CVD risk ACEI, ARB, thiazide, or DHPCCB without additional CVD risk
	CKD	<140/90	ACEI or ARB
ADA 2013[39]	Diabetes	<140/80	ACEI or ARB
KDIGO 2012[40]	CKD no proteinuria	≤140/90	ACEI or ARB
	CKD + proteinuria	≤130/80	
NICE 2011[41]	General <80 y	<140/90	<55 y: ACEI or ARB
	General ≥80 y	<150/90	≥55 y or black: CCB
ISHIB 2010[42]	Black, lower risk	<135/85	Diuretic or CCB
	Target organ damage or CVD risk	<130/80	

Hypertension
Collaborative Care

- **Drug Therapy and Patient Teaching**
  - **Identify, report, and minimize side effects**
    - **Orthostatic hypotension**
    - **Sexual dysfunction**
    - **Dry mouth**
    - **Frequent urination**



Primary Hypertension

Nursing Management

Nursing Diagnoses

- Ineffective health maintenance
- Anxiety
- Sexual dysfunction
- Ineffective therapeutic regimen management r/t
  - lack of S/S of HTN, side effects of Rx, cost of Rx, etc.

Primary Hypertension

Nursing Management

Nursing Implementation

Health Promotion

- **Individual patient evaluation**
- **Screening programs**
- **Cardiovascular risk factor modification**

Hypertensive Crisis

- Severe, abrupt elevation in BP
- The rate of ↑ in BP is more important than the absolute value
- Most common in patients with a history of HTN who have failed to comply with medications or who have been under-medicated

Hypertensive Crisis
Clinical Manifestations

- Hypertensive encephalopathy (H/A, N & V, seizures, confusion, coma)
- Renal insufficiency
- Heart failure
- Pulmonary edema

Hypertensive Crisis
Nursing and Collaborative Management

Hospitalization

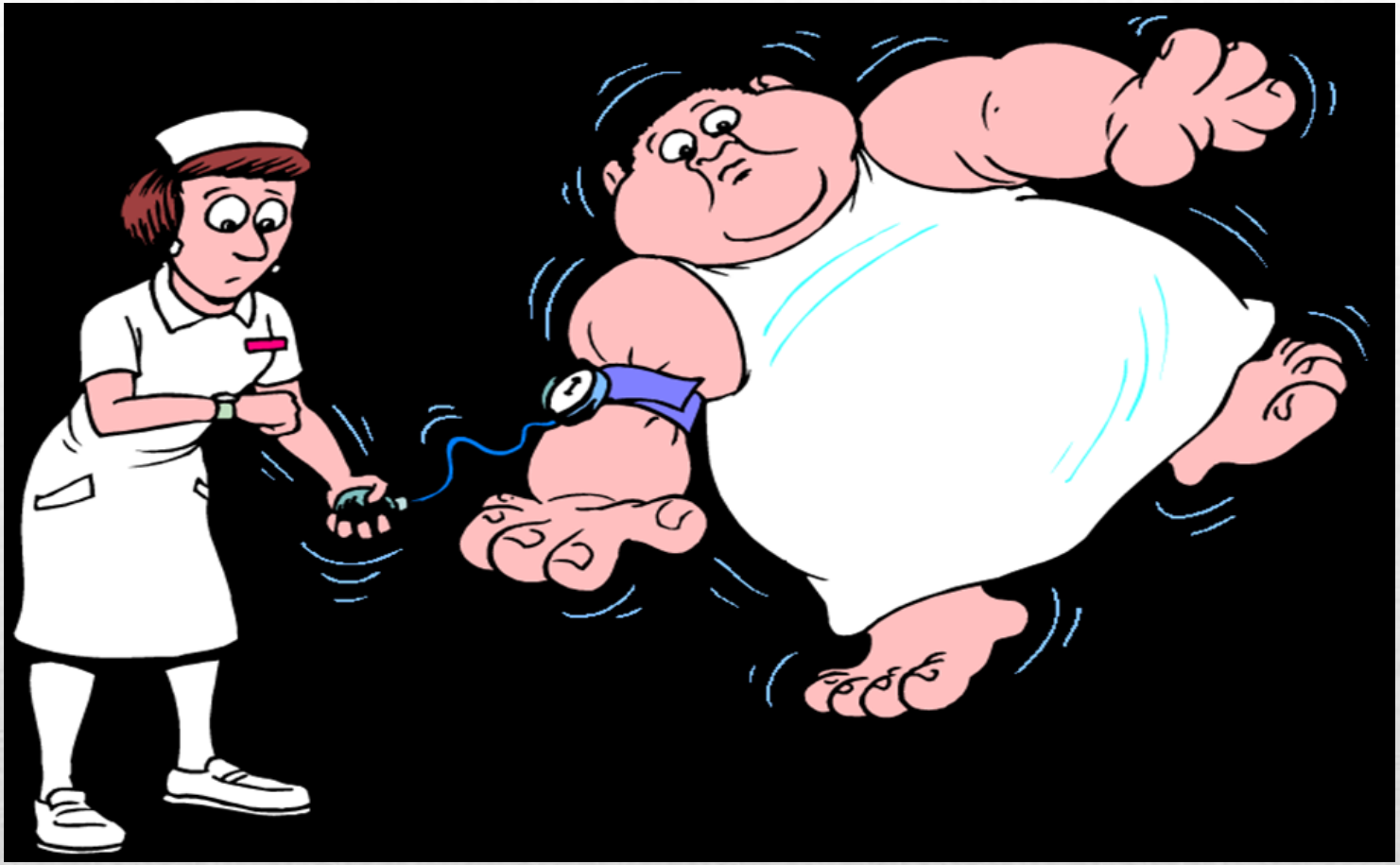
- IV drug therapy
- Monitor cardiac and renal function
- Neurologic checks
- Determine cause
- Education to avoid future crises

Parenteral drugs for treatment of hypertensive emergencies*

Drug	Dose	Onset of action	Duration of action	Adverse effects•	Special indications
Vasodilators					
Sodium nitroprusside	0.25-10 µg/kg/min as IV infusion$^{\Delta}$	Immediate	1-2 min	Nausea, vomiting, muscle twitching, sweating, thiocynate and cyanide intoxication	Most hypertensive emergencies; caution with high intracranial pressure or azotemia
Nicardipine hydrochloride	5-15 mg/h IV	5-10 min	15-30 min, may exceed 4 h	Tachycardia, headache, flushing, local phlebitis	Most hypertensive emergencies except acute heart failure; caution with coronary ischemia
Clevidipine	1-2 mg/h IV with rapid titration to max of 16 mg/h	1-2 min	5-15 min	Atrial fibrillation, nausea	All hypertensive emergencies
Fenoldopam mesylate	0.1-0.3 µg/kg per min IV infusion	<5 min	30 min	Tachycardia, headache, nausea, flushing	Most hypertensive emergencies; caution with glaucoma
Nitroglycerin	5-100 µg/min as IV infusion	2-5 min	5-10 min	Headache, vomiting, methemoglobinemia, tolerance with prolonged use	Coronary ischemia
Enalaprilat	1.25-5 mg every 6 h IV	15-30 min	6-12 h	Precipitous fall in pressure in high-renin states; variable response	Acute left ventricular failure; avoid in acute myocardial infarction
Hydralazine hydrochloride	10-20 mg IV	10-20 min IV	1-4 h IV	Tachycardia, flushing, headache, vomiting, aggravation of angina	Eclampsia
	10-40 mg IM	20-30 min IM	4-6 h IM		

Parenteral drugs for treatment of hypertensive emergencies, continued*

Drug	Dose	Onset of action	Duration of action	Adverse effects•	Special indications
Andrenergic inhibitors					
Labetalol hydrochloride	20-80 mg IV bolus every 10 min	5-10 min	3-6 h	Vomiting, scalp tingling, bronchoconstriction, dizziness, nausea, heart block, orthostatic hypotension	Most hypertensive emergencies except acute heart failure
	0.5-2.0 mg/min IV infusion				
Esmolol hydrochloride$^{\Delta}$	250-500 µg/kg/min by infusion; may repeat bolus after 5 min or increase infusion to 300 µg/min	1-2 min	10-30 min	Hypotension, nausea, asthma, first-degree heart block, HF	Aortic dissection, perioperative
Phentolamine	5-15 mg IV bolus	1-2 min	10-30 min	Tachycardia, flushing, headache	Catecholamine excess



This is not the end...

Controversy