HYPERTENSIVE CRISIS

MOHAMMED R ARAFAH
MBBS FACP FRCPC FACC
PROFESSOR OF CARDIOLOGY

Proposed new definition of hypertension

- is a progressive cardiovascular syndrome arising from complex and interrelated etiologies.
- Early markers of the syndrome are often present before blood-pressure elevation is sustained; therefore, hypertension cannot be classified solely by discreet blood-pressure thresholds.
- Progression is strongly associated with function and structural cardiac and vascular abnormalities that damage the heart, kidneys, brain, vasculature and other organs and lead to premature morbidity and death.

ASH Writing Group 2005

Joint National Committee VII

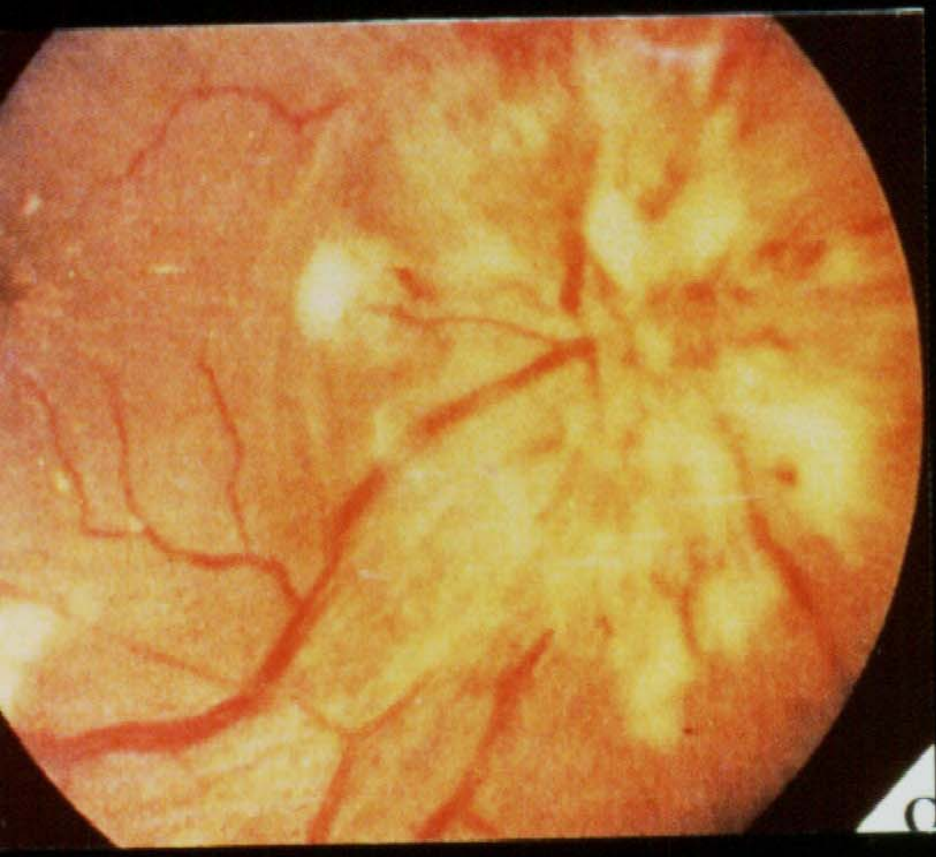
Blood Pressure Classification

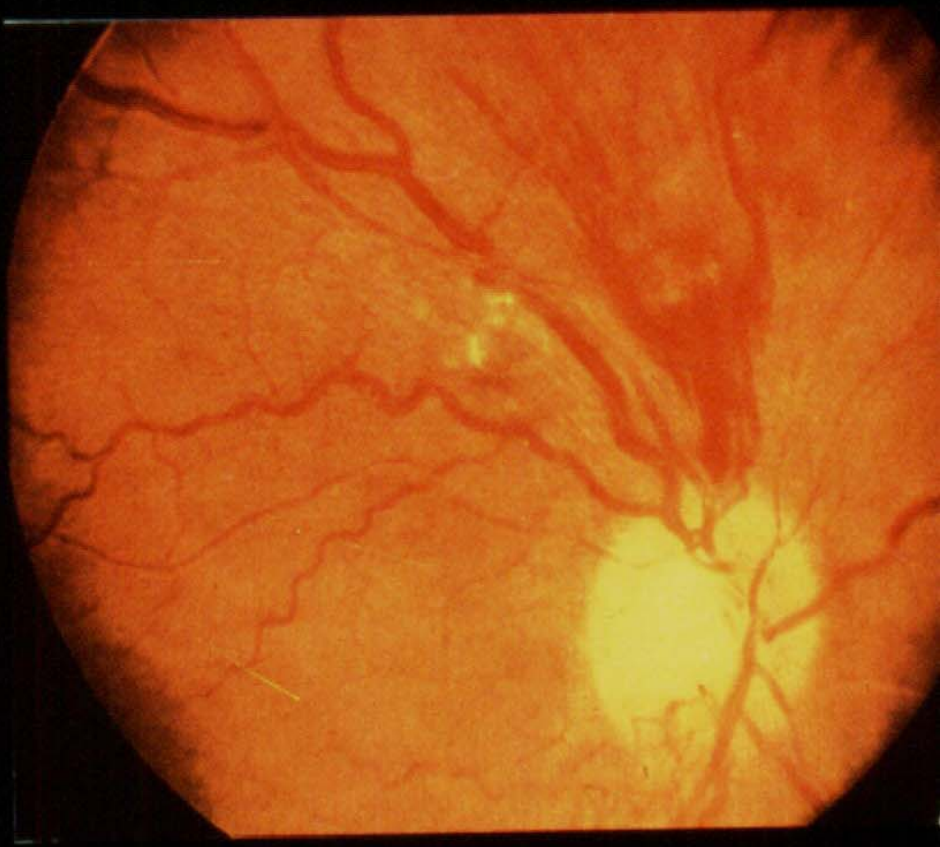
BP Classification	SBP mmHg		DBP mmHg
Normal	<120	and	<80
Prehypertension	120–139	or	80–89
Stage 1 Hypertension	140–159	or	90–99
Stage 2 Hypertension	≥160	or	≥100

TABLE 28–17. CLINICAL CHARACTERISTICS OF HYPERTENSIVE CRISIS

Blood pressure: Usually >140 mm Hg diastolic
Funduscopic findings: Hemorrhage, exudate, papilledema
Neurological status: Headache, confusion, somnolence, stupor, visual loss, focal deficits, seizures, coma
Cardiac findings: Prominent apical impulse, cardiac enlargement, congestive failure
Renal: Oliguria, azotemia
Gastrointestinal: Nausea, vomiting

From Kaplan NM: Clinical Hypertension. 6th ed. Baltimore, Williams & Wilkins, 1994, p 283.



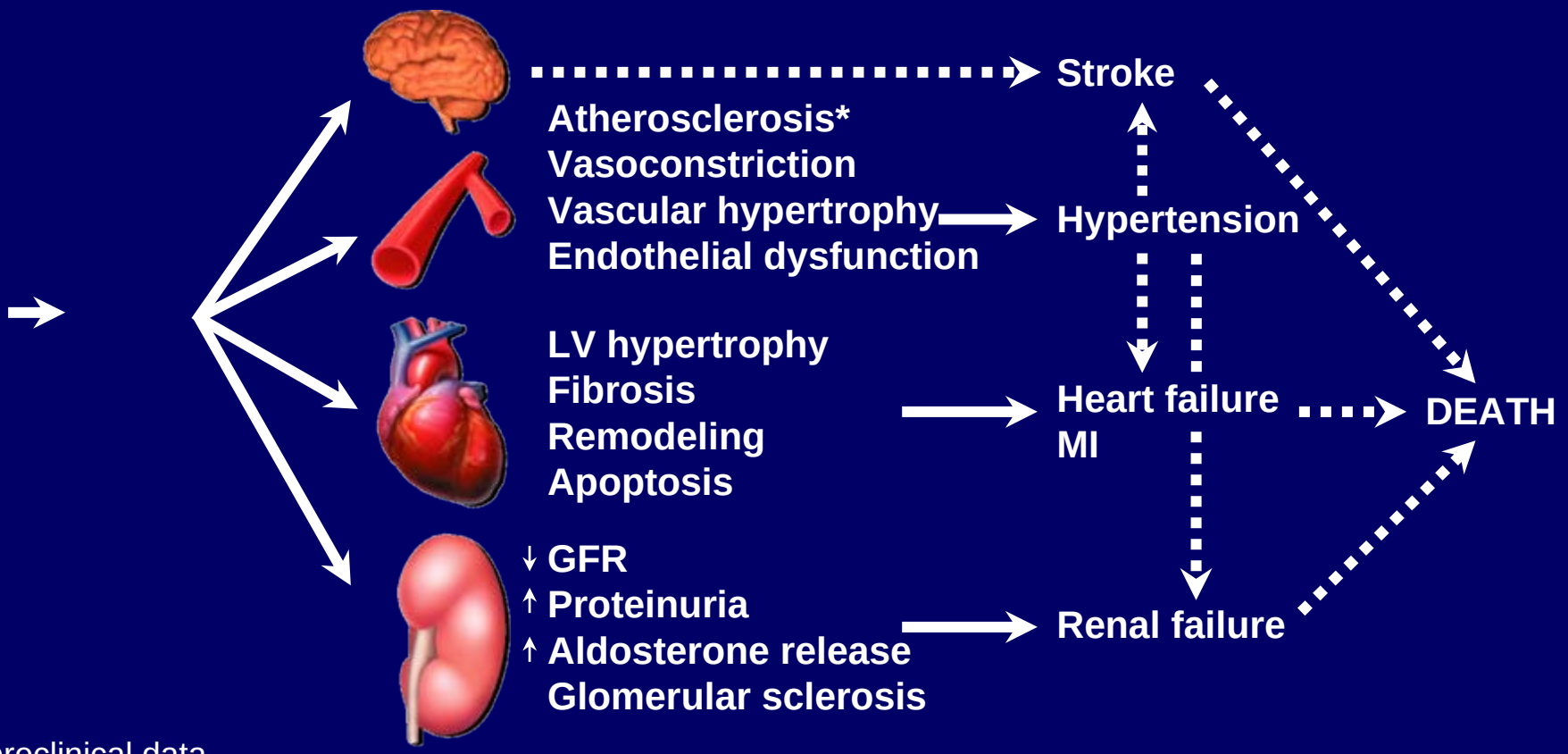


Hypertensive Urgencies and Emergencies

- Patients with marked BP elevations and acute TOD (e.g., encephalopathy, myocardial infarction, unstable angina, pulmonary edema, eclampsia, stroke, head trauma, life-threatening arterial bleeding, or aortic dissection) require hospitalization and parenteral drug therapy.

- Patients with markedly elevated BP but without acute TOD usually do not require hospitalization, but should receive immediate combination oral antihypertensive therapy.

Target Organ Damage



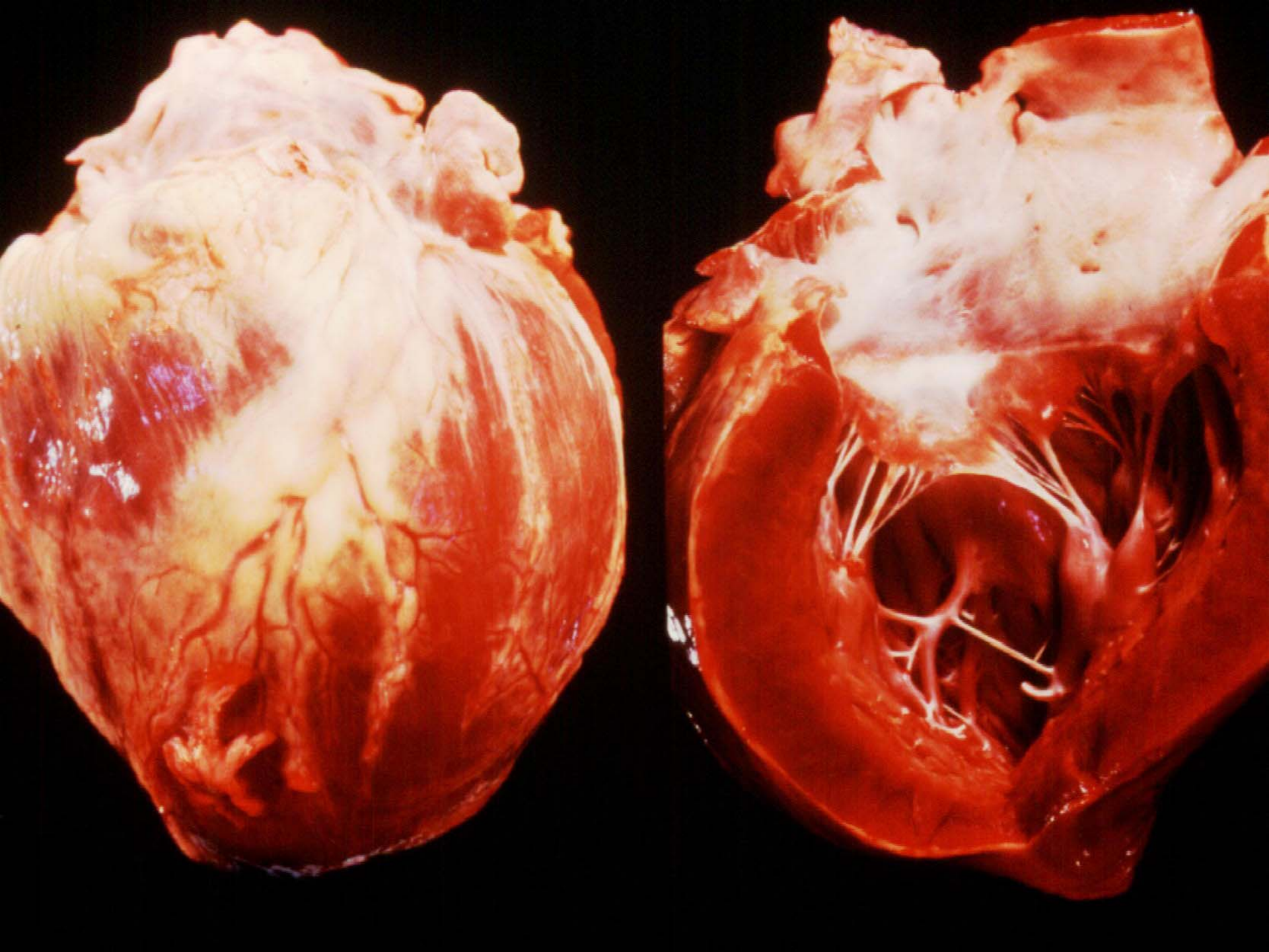
*preclinical data

LV = left ventricular; MI = myocardial infarction; GFR = glomerular filtration rate

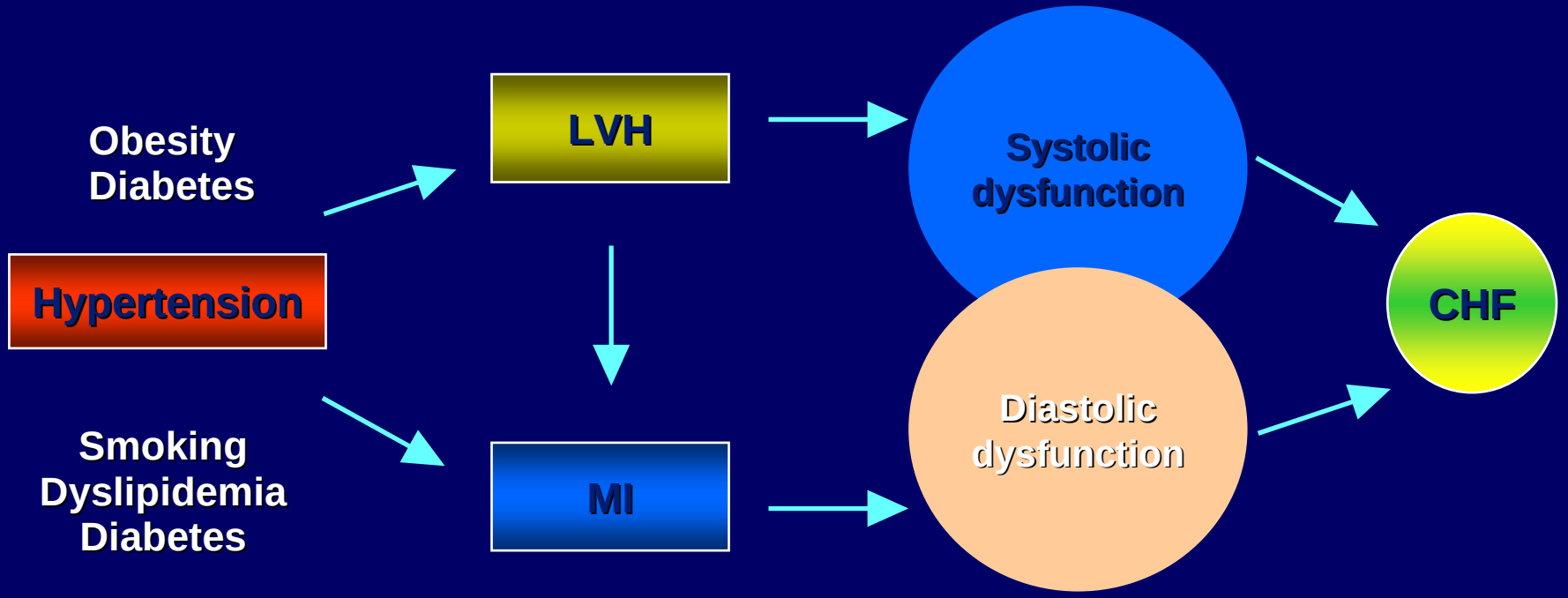
Adapted from Willenheimer R et al *Eur Heart J* 1999; 20(14): 997–1008, Dahlöf B *J Hum Hypertens* 1995; 9(suppl 5): S37–S44, Daugherty A et al *J Clin Invest* 2000; 105(11): 1605–1612, Fyhrquist F et al *J Hum Hypertens* 1995; 9(suppl 5): S19–S24, Booz GW, Baker KM *Heart Fail Rev* 1998; 3: 125–130, Beers MH, Berkow R, eds. *The Merck Manual of Diagnosis and Therapy*. 17th ed. Whitehouse Station, NJ: Merck Research Laboratories 1999: 1682–1704, Anderson S *Exp Nephrol* 1996; 4(suppl 1): 34–40, Fogo AB *Am J Kidney Dis* 2000; 35(2): 179–188

Target Organ Damage

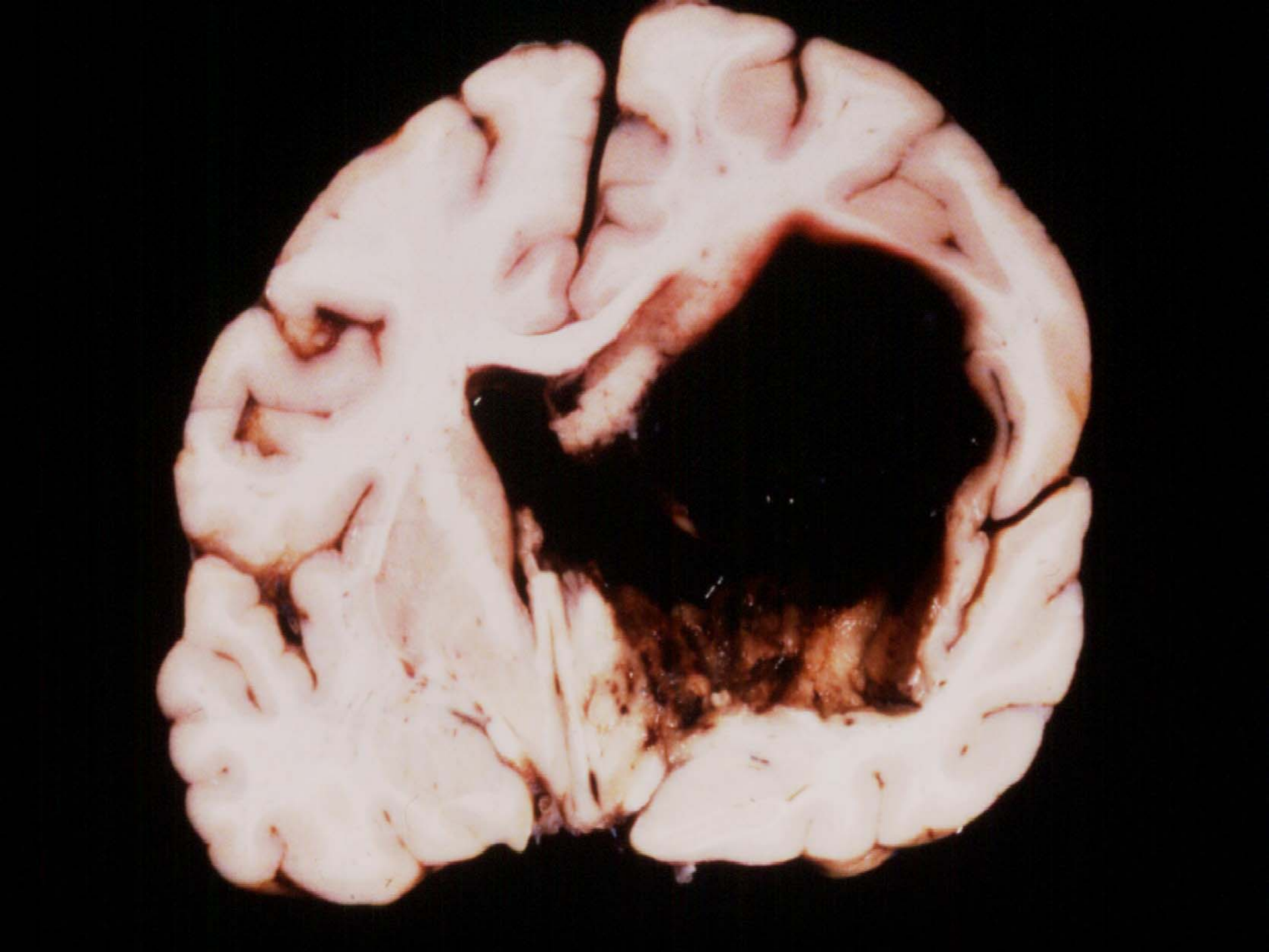
- Heart
  - Left ventricular hypertrophy
  - Angina or prior myocardial infarction
  - Prior coronary revascularization
  - Heart failure
- Brain
  - Stroke or transient ischemic attack
- Chronic kidney disease
- Peripheral arterial disease
- Retinopathy



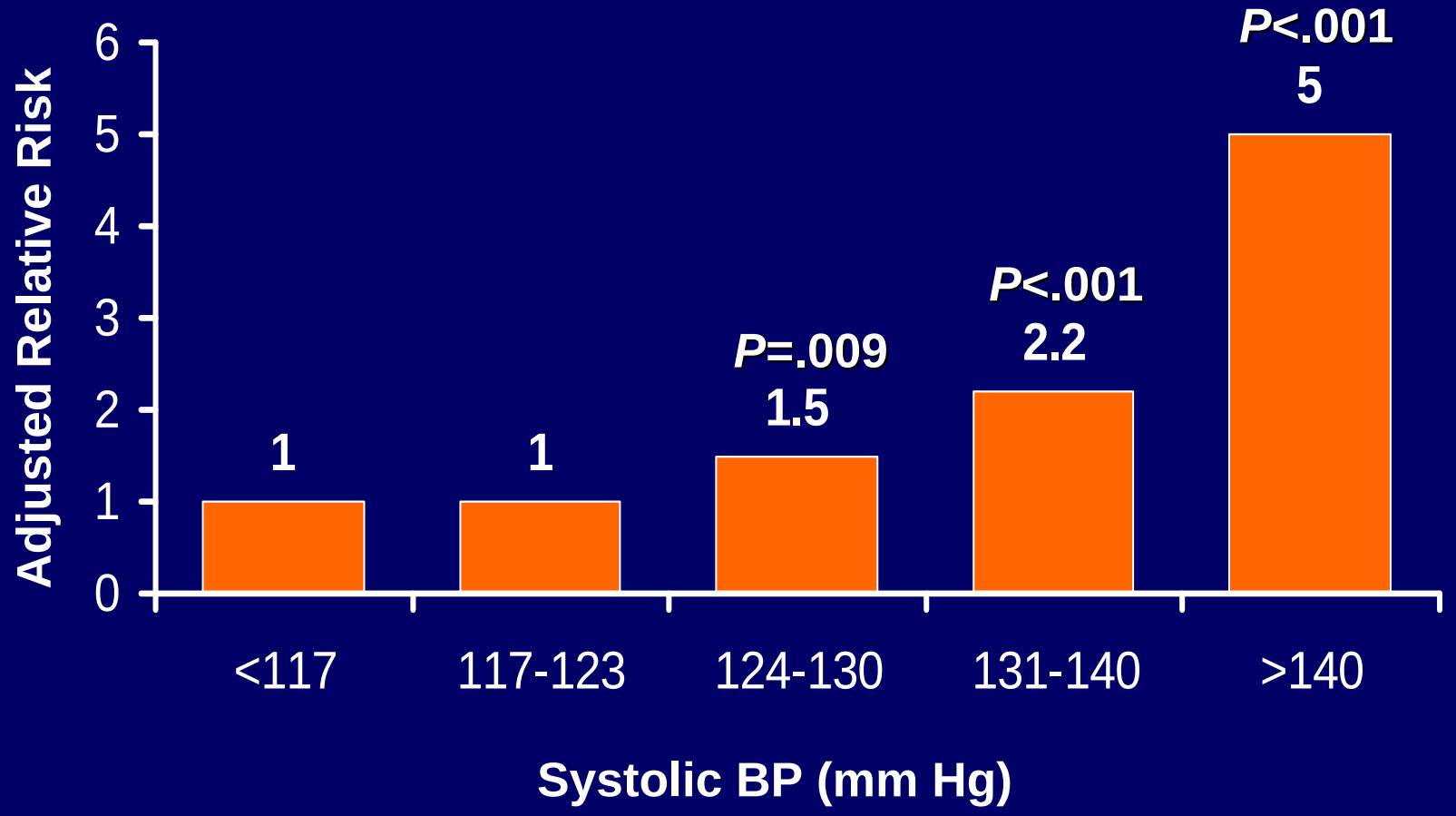
Progression From Hypertension to CHF



Vasan RS et al. Arch Intern Med 1996



Increasing Systolic BP Linked to End-Stage Renal Disease Risk: MRFIT



Klag et al. *N Engl J Med*. 1996;334:13-18.

TABLE 28–16. CIRCUMSTANCES REQUIRING RAPID TREATMENT OF HYPERTENSION
Accelerated-malignant hypertension with papilledema
Cerebrovascular
Hypertensive encephalopathy
Atherothrombotic brain infarction with severe hypertension
Intracerebral hemorrhage
Subarachnoid hemorrhage
Cardiac
Acute aortic dissection
Acute left ventricular failure
Acute or impending myocardial infarction
After coronary bypass surgery
Renal
Acute glomerulonephritis
Renal crises from collagen-vascular diseases
Severe hypertension after kidney transplantation
Excessive circulating cathecholamines
Pheochromocytoma crisis
Food or drug interactions with monoamine oxidase inhibitors
Sympathomimetic drug use (cocaine)
Rebound hypertension after sudden cessation of antihypertensive drugs
Eclampsia

MANAGMENT

- In hypertensive urgencies critically elevated BP should be lowered rapidly (within 15-30minutes reduction of MBP by 25%, aim DBP 100-110, SBP 160 mm Hg) .
- Avoid sudden drop of BP which lead to reduction of perfusion to vital organs (brain, heart,. etc).
- **In hypertensive emergencies critically elevated BP should be lowered gradually within hours (aim DBP 100-110 mm Hg, SBP 160 mm Hg).**

TABLE 29–12. PARENTERAL DRUGS FOR TREATMENT OF HYPERTENSIVE EMERGENCY (IN ORDER OF RAPIDITY OF ACTION)

DRUG	DOSAGE	ONSET OF ACTION	ADVERSE EFFECTS
Vasodilators			
Nitroprusside (Nipride, Nitropress)	0.25–10 μg/kg/min as IV infusion	Instantaneous	Nausea, vomiting, muscle twitching, sweating, thiocyanate intoxication
Nitroglycerin	5–100 μg/min as IV infusion	2–5 min	Tachycardia, flushing, headache, vomiting, methemoglobinemia
Nicardipine (Cardene)	5–15 mg/hr IV	5–10 min	Tachycardia, headache, flushing, local phlebitis
Hydralazine (Apresoline)	10–20 mg IV 10–50 mg IM	10–20 min 20–30 min	Tachycardia, flushing, headache, vomiting, aggravation of angina
Enalapril (Vasotec IV)	1.25–5 mg q 6 hr	15 min	Precipitous fall in blood pressure in high renin states; response variable
Fenoldopam (Corlopam)	0.1–0.3 μg/kg/min	<5 min	Tachycardia, headache, nausea, flushing
Adrenergic inhibitors			
Phentolamine (Regitine)	5–15 mg IV	1–2 min	Tachycardia, flushing
Esmolol (Brevibloc)	500 μg/kg/min for 4 min, then 150–300 μg/kg/min IV	1–2 min	Hypotension
Labetalol (Normodyne, Trandate)	20–80 mg IV bolus every 10 min 2 mg/min IV infusion	5–10 min	Vomiting, scalp tingling, burning in throat, postural hypotension, dizziness, nausea

Clinical Condition	Preferred Treatment
Acute Pulmonary Edema	Furosemide 40 mg I.V.
Acute Myocardial Ischemia	Labetalol or Esmolol in combination with Nitroglycerin (up to 200 mg/min). Nicardipine may be added if pressure is controlled poorly with Labetalol/Esmolol alone.
Hypertensive Encephalopathy	Labetalol or Nicardipine
Acute Aortic Dissection	Labetalol or combination of Nitroprusside and Esmolol.
Eclampsia	Hydralazine (traditional). In the ICU, Labetalol or Nicardipine is preferred.
Acute Renal Failure	Nicardipine or Fenoldopam
Microangiopathic Hemolytic Anemia	Nicardipine or Fenoldopam
Pheochromocytoma	Phentolamine I.V. followed by oral Phenoxybenzamine
Clonidine withdrawal	Oral Cloindine (0.1 mg every 20 min)

TABLE 28–18. CONDITIONS TO BE DIFFERENTIATED FROM A HYPERTENSIVE CRISIS

Acute left ventricular failure
Uremia from any cause, particularly with volume overload
Cerebrovascular accident
Subarachnoid hemorrhage
Brain tumor
Head injury
Epilepsy (postictal)
Collagen diseases, particularly lupus, with cerebral vasculitis
Encephalitis
Overdose and withdrawal from narcotics, amphetamines, etc.
Hypercalcemia
Acute anxiety with hyperventilation syndrome

Joint National Committee VII

Benefits of Lowering BP

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

Patient Evaluation

Evaluation of patients with documented HTN has three objectives:

1. Assess lifestyle and identify other CV risk factors or concomitant disorders that affects prognosis and guides treatment.

2. Reveal identifiable causes of high BP.

3. Assess the presence or absence of target organ damage and CVD.

CVD Risk Factors

- Hypertension*
- Cigarette smoking
- Obesity* (BMI ≥30 kg/m^2)
- Physical inactivity
- Dyslipidemia*
- Diabetes mellitus*
- Microalbuminuria or estimated GFR <60 ml/min
- Age (older than 55 for men, 65 for women)
- Family history of premature CVD
  (men under age 55 or women under age 65)

*Components of the metabolic syndrome.

Identifiable Causes of Hypertension

- Sleep apnea
- Drug-induced or related causes
- Chronic kidney disease
- Primary aldosteronism
- Renovascular disease
- Chronic steroid therapy and Cushing's syndrome
- Pheochromocytoma
- Coarctation of the aorta
- Thyroid or parathyroid disease

Joint National Committee VII

Laboratory Tests

- Routine Tests
  - Electrocardiogram
  - Urinalysis
  - Blood glucose, and hematocrit
  - Serum potassium, creatinine, or the corresponding estimated GFR, and calcium
  - Lipid profile, after 9- to 12-hour fast, that includes high-density and low-density lipoprotein cholesterol, and triglycerides
- Optional tests
  - Measurement of urinary albumin excretion or albumin/creatinine ratio
- More extensive testing for identifiable causes is not generally indicated unless BP control is not achieved

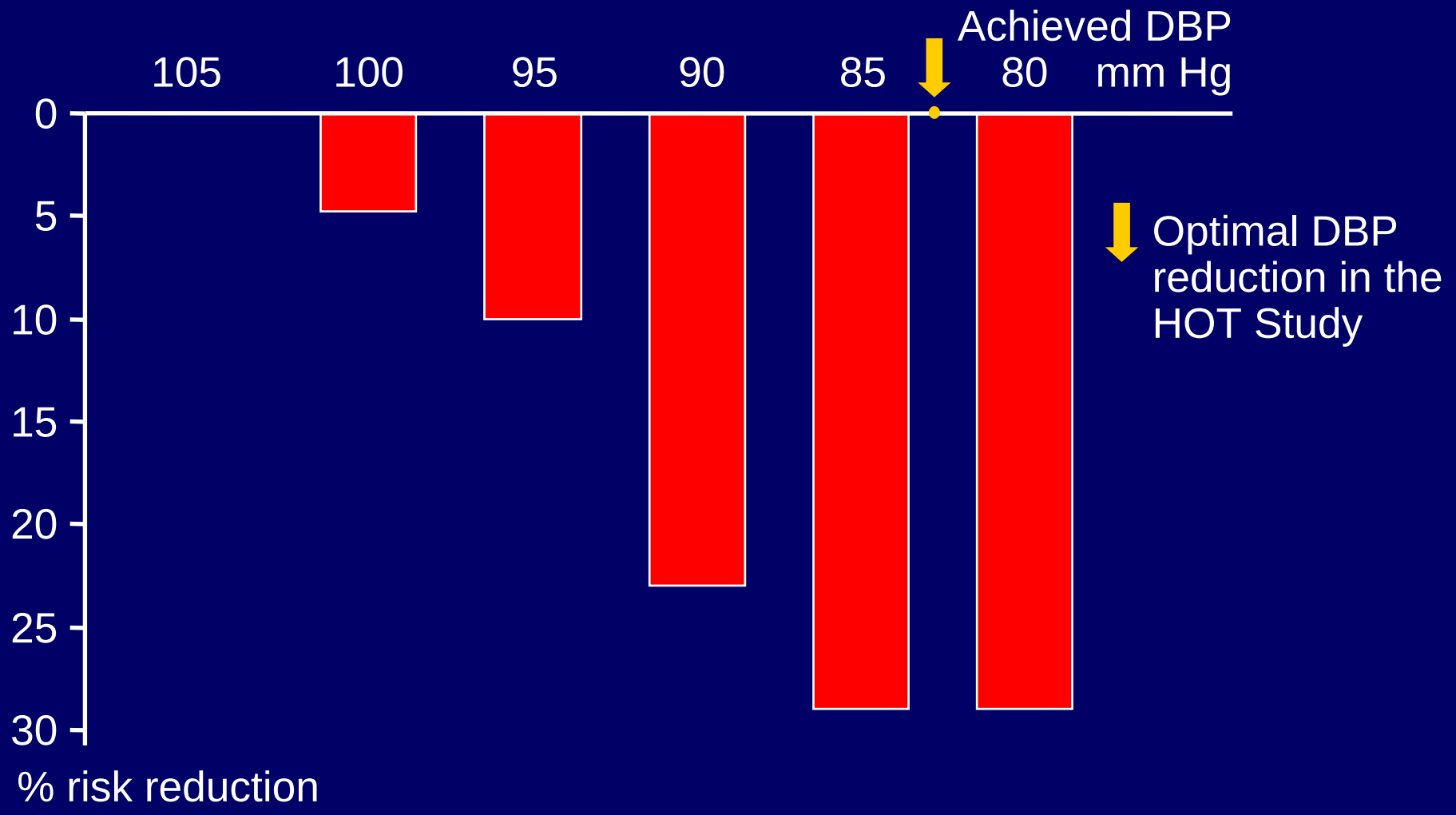
Goals of Therapy

- Reduce CVD and renal morbidity and mortality.
- Treat to BP <140/90 mmHg or BP <130/80 mmHg in patients with diabetes or chronic kidney disease.
- Achieve SBP goal especially in persons ≥50 years of age.

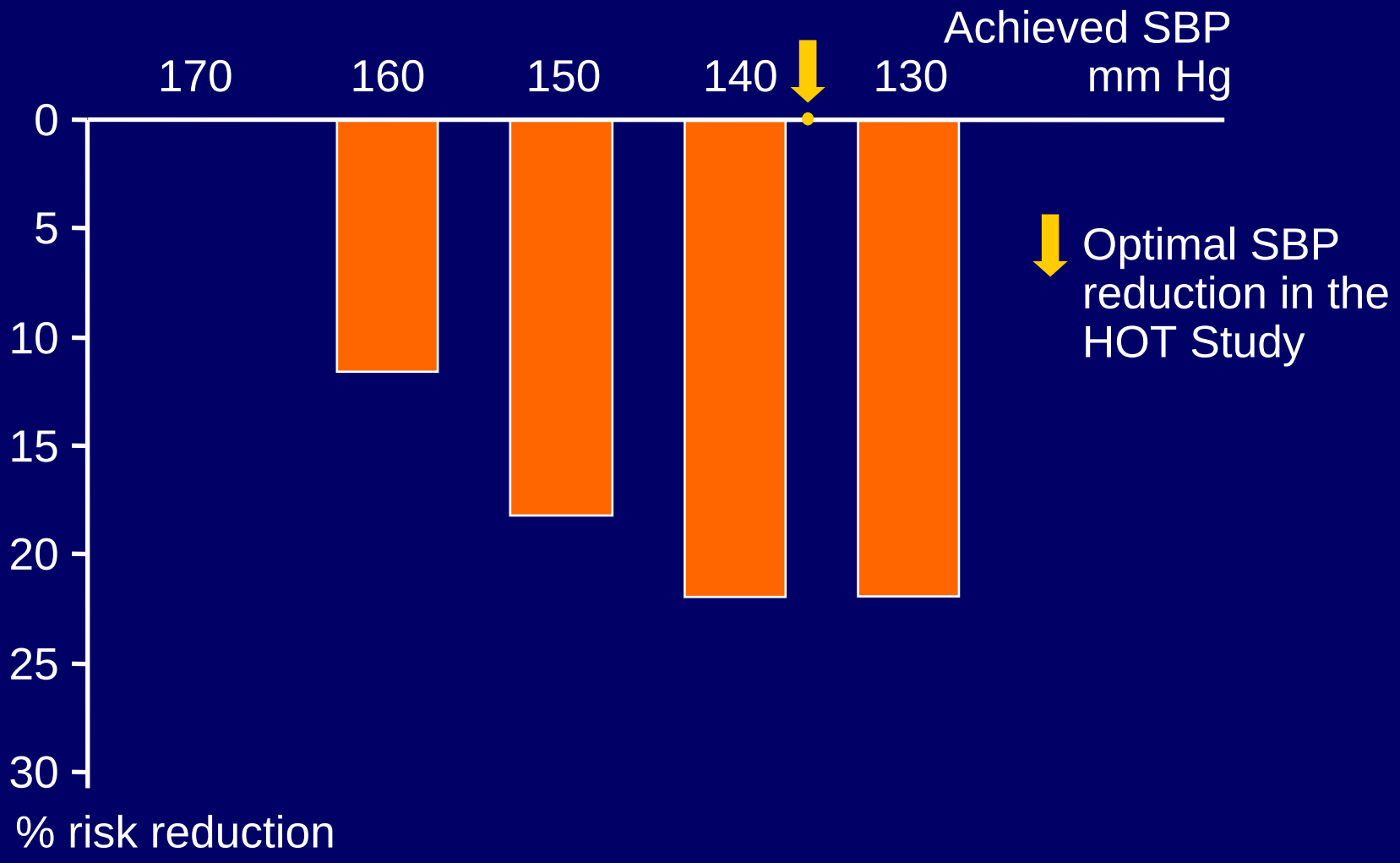
Causes of Resistant Hypertension

- Improper BP measurement
- Excess sodium intake
- Inadequate diuretic therapy
- Medication
  - Inadequate doses
  - Drug actions and interactions (e.g., nonsteroidal anti-inflammatory drugs (NSAIDs), illicit drugs, sympathomimetics, oral contraceptives)
  - Over-the-counter (OTC) drugs and herbal supplements
- Identifiable causes of HTN

Risk of a major cardiovascular event reduced by 30% in the HOT Study



Risk of a major cardiovascular event reduced by 22% in the HOT Study



Parenteral Agents for Treatment of Hypertensive Emergencies

Drug	Intravenous Dose	Onset of Action	Duration of Action	Adverse Effects/Comments	Indications/Comments
Nitroprusside	0.25–10 μg/kg/min	Immediate	1–2 min	Nausea, vomiting, tachycardia, fluid retention, fasciculations; risk of thiocyanate and cyanide toxicity increased with renal insufficiency, higher doses, and prolonged infusion; patient must be shielded from light	Most hypertensive emergencies
Nitroglycerin	5–100 μg/min	2–5 min	2–5 min	Headache, nausea; tolerance can occur with prolonged use; risk of methemoglobinemia increases with prolonged use	Angina, acute myocardial infarction
Labetalol	20–80 mg IV bolus q 5–10 min; 0.5–2.0 mg/min	5–10 min	3–6 hr	Heart block, bradycardia, heart failure, bronchospasm, nausea, scalp tingling, vomiting, paradoxical pressor response; may not be effective in patients receiving α- or β-antagonists	Most hypertensive emergencies, including aortic dissection and catecholamine crisis; avoid in heart failure
Fenoldopam	0.1–0.3 μg/kg/min	<5 min	30 min	Diuretic effects may exacerbate volume depletion	Most hypertensive emergencies
Hydralazine	5–10 mg q 20 min up to 20 mg	10–20 min	3–6 hr	Headache, nausea, tachycardia, flushing, worsening of angina, local thrombophlebitis (change infusion site after 12 hr)	Eclampsia
Enalaprilat	1.25–5 mg q 6 hr administered over a 5-min period	15–30 min	6–8 hr	Response variable; in high-renin states may see profound drop in blood pressure	Heart failure; pulmonary edema
Nicardipine	5 mg/hr, increase by 1–2.5 mg/hr q 15 min up to 15 mg/hr	5–10 min	1–4 hr	Tachycardia, worsening angina, headache	Most hypertensive emergencies except heart failure, angina, myocardial infarction
Esmolol	500 μg/kg/min for 1 min, then 50–300 μg/kg/min for 4 min; repeat sequence as needed	1–2 min	10–20 min	Nausea	Perioperative hypertension; aortic dissection when used in combination with a vasodilator such as nitroprusside
Phentolamine	5–10 mg q 5–15 min	1–2 min	3–10 min	Tachycardia, headache, angina, paradoxical pressor response	Catecholamine crisis