ATUDER
Acil Tıp Uzmanları Derneği

10. ULUSAL
ACİL TIP KONGRESİ
1st INTERCONTINENTAL
EMERGENCY MEDICINE CONGRESS

HYPERTENSIVE EMERGENCIES

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Introduction

- Hypertension (HT) is the **most common** primary diagnosis in America
- Globally, the overall prevalence of HT in adults >25 yrs is ~40% in 2008
- 600 million in 1980 to ~1 billion in 2008
- Causes 7.5 million deaths (12.8% of total deaths) annually

The New HT (JNC 8) Guidelines

- The last version (JNC 7) was published back in 2003

- The new (JNC 8) guidelines were published online Dec 18, 2013. Called "2014 guidelines"

Special Communication

2014 Evidence-Based Guideline for the Management of High Blood Pressure in Adults
Report From the Panel Members Appointed to the Eighth Joint National Committee (JNC 8)

Paul A. James, MD; Suzanne Oparil, MD; Barry L. Carter, PharmD; William C. Cushman, MD; Cheryl Dennison-Himmelfarb, RN, ANP, PhD; Joel Handler, MD; Daniel T. Lackland, DrPH; Michael L. LeFevre, MD, MSPH; Thomas D. MacKenzie, MD, MSPH; Olugbenga Ogedegbe, MD, MPH, MS; Sidney C. Smith Jr, MD; Laura P. Svetkey, MD, MHS; Sandra J. Taler, MD; Raymond R. Townsend, MD; Jackson T. Wright Jr, MD, PhD; Andrew S. Narva, MD; Eduardo Ortiz, MD, MPH

JAMA. doi:10.1001/jama.2013.284427
Published online December 18, 2013.

Definition

- A systolic blood pressure **(SBP) >139 mmHg** and/or
- A diastolic **(DBP) >89 mmHg**
- Based on the average of **two or more** properly measured, seated BP readings on each of **two or more** office visits

Classification

Table 1. Classification and management of blood pressure for adults*

BP Classification	SBP* mmHg	DBP* mmHg	Lifestyle Modification	Initial drug therapy	
				Without Compelling Indication	With Compelling Indications (See Table 8)
Normal	<120	and <80	Encourage	No antihypertensive drug indicated.	Drug(s) for compelling indications.‡
Prehypertension	120–139	or 80–89	Yes		
Stage 1 Hypertension	140–159	or 90–99	Yes	Thiazide-type diuretics for most. May consider ACEI, ARB, BB, CCB, or combination.	Drug(s) for the compelling indications.‡ Other antihypertensive drugs (diuretics, ACEI, ARB, BB, CCB) as needed.
Stage 2 Hypertension	≥160	or ≥100	Yes	Two-drug combination for most† (usually thiazide-type diuretic and ACEI or ARB or BB or CCB).	

www.nhlbi.nih.gov

Hypertensive Crises

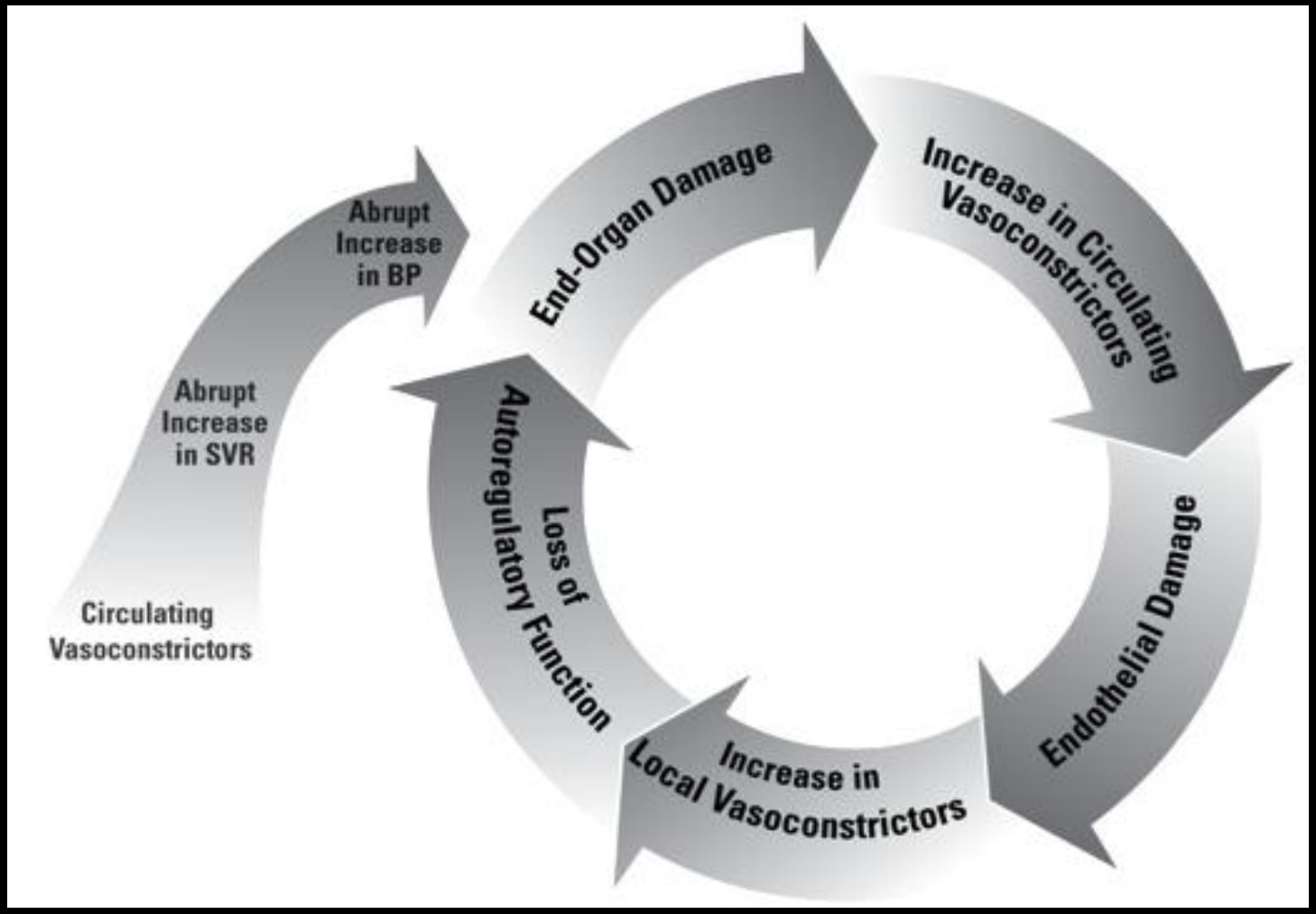
- **Hypertensive Urgencies**: No progressive target-organ dysfunction (Accelerated Hypertension)
- **Hypertensive Emergencies**: Progressive end-organ dysfunction (Malignant Hypertension)

Hypertensive Emergencies

- Severely elevated BP (>180/120mmHg)
- **With** progressive target organ dysfunction
- Require emergent lowering of BP

- **Examples: Severely elevated BP** with
  - -Hypertensive encephalopathy
  - -Acute left ventricular failure with pulmonary edema
  - -Acute MI or unstable angina pectoris
  - -Dissecting aortic aneurysm

Pathophysiology of a Hypertensive Emergency



Ault and Ellrodt. Am J Emerg Med 1985; (suppl 6):10-15
Varon and Marik. Chest. 2000;118:214-27

Pathophysiology of Hypertensive Emergency

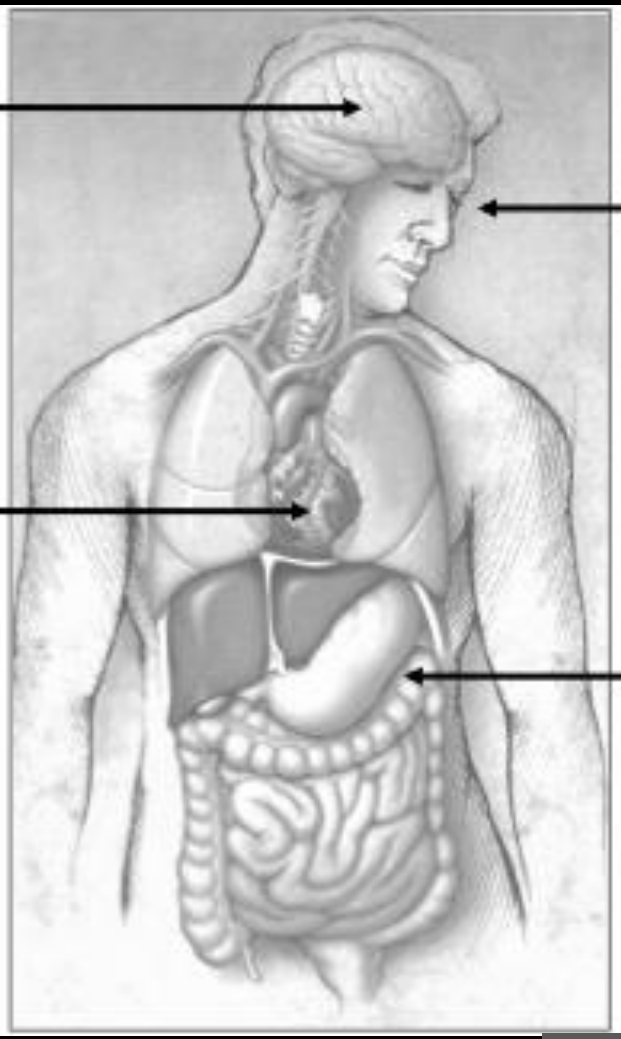
- Not well understood
- Failure of normal autoregulation + abrupt rise in SVR
- Increase in SVR due to release of humoral vasoconstrictors from the stressed vessel wall
- Endothelium plays a central role in BP homeostasis via substances as Nitric Oxide and prostacyclin
- Increased pressure starts a cycle of
  - endothelial damage
  - local activation of clotting cascade
  - fibrinoid necrosis of small vessels
  - release of more vasoconstrictors
- Process leads to progressive increase in resistance and further endothelial dysfunction

Target Organs

- Nervous system
- CVS (Heart and Blood Vessels)
- The Eyes (Retinopathy)
- The kidneys

- Single organ involvement in approximately 83%
- Two organ involvement found in 14%
- Multiorgan involvement found in 3%

What Constitutes a Hypertensive Emergency?



Brain
Hypertensive Encephalopathy
Ischemic Stroke
Hemorrhagic Stroke
Subarachnoid Hemorrhage

Retina
Hemorrhages
Exudates
Papilledema

Cardiovascular System
Unstable Angina
Acute Heart Failure
Acute Myocardial Infarction
Aortic Dissection

Kidney
Hematuria
Proteinuria
Decreasing Renal Function

Varon and Marik. Chest 2000;118:214-27
Rynn et al. J Pharm Prac 2005;18:363-76

What End-Organs Are Typically Involved?

End-organ damage type	Cases (%)
Cerebral infarction	24.5
Intracerebral or subarachnoid bleed	4.5
Hypertensive encephalopathy	16.3
Acute pulmonary edema	22.5
Acute congestive heart failure	14.3
Acute myocardial infarction or unstable angina	12.0
Aortic dissection	2.0
Eclampasia	2.0

Zampaglione et al. Hypertension 1996;27:144-7

Effects on CVS

- Ventricular hypertrophy, dysfunction and failure, pulmonary edema
- Arrhytmias
- Myocardial ischemia, Acute MI
- Arterial aneurysm, dissection, and rupture

Effects on the Kidneys

- The renal system is impaired when high BP leads to arteriosclerosis, fibrinoid necrosis, and an overall impairment of renal protective autoregulation mechanisms
- This may manifest as worsening renal function, hematuria, RBC cast formation, and/or proteinuria

Nervous System

- Elevated BP overwhelms the normal cerebral autoregulation. This results in transudate leak across capillaries and continued arteriolar damage. The end result of loss of autoregulation is hypertensive encephalopathy
- Hypertensive encephalopathy;
  - Clinical manifestation of cerebral edema and microhemorrhages, altered mental status, headache, vomiting and seizures with dysfunction of cerebral autoregulation
  - Defined as an acute organic brain syndrome or delirium in the setting of severe hypertension
- Stroke, intracerebral and subaracnoid hemorrhage
- Cerebral atrophy and dementia

HT Encephalopathy

- **Symptoms**
  - Severe headache
  - Nausea and vomiting
  - Visual disturbances
  - Confusion
  - Focal or generalized weakness
- **Signs**
  - Disorientation
  - Focal neurologic defects
  - Focal or generalized seizures
  - Nystagmus

Not adequately treated – cerebral haemorrhage, coma and death

BUT with proper treatment – **completely reversible**

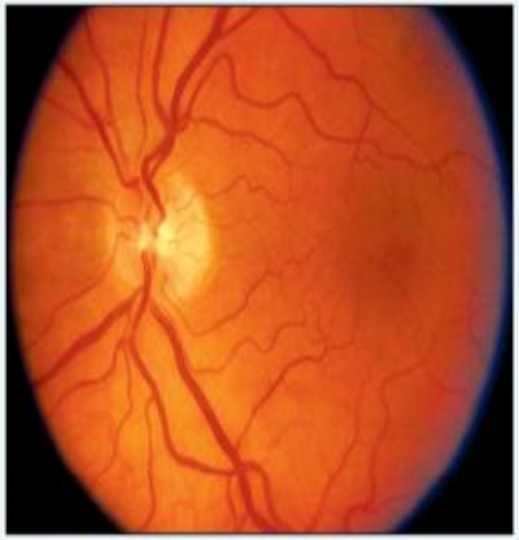
The Eyes

- Retinopathy, retinal hemorrhages and impaired vision
- Vitreous hemorrhage, retinal detachment
- Neuropathy of the nerves leading to extraocular muscle paralysis and dysfunction

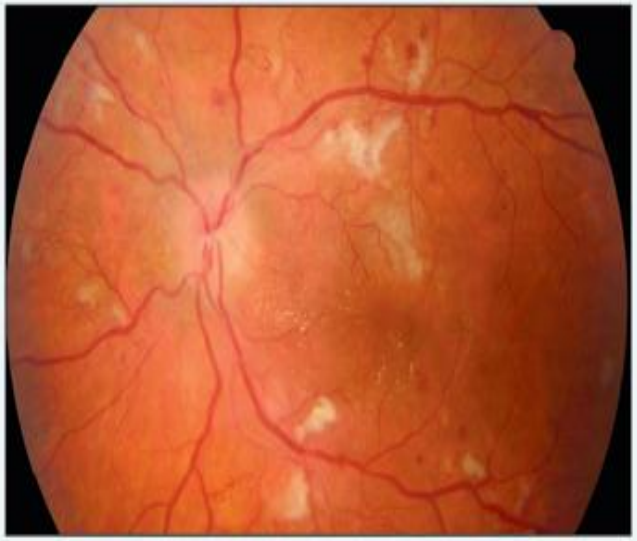
HT Retinopathy - Fundoscopy

- Keith-Wagener classification
  - Stage I- arteriolar sclerosis with thickening, irregularity and tortuosity
  - Stage II- AV dipping or compression
  - Stage III- Flame shaped haemorrhages and cotton wool spots
  - Stage IV- Papilledema
- "Stage III and IV lesions - imply failure of the CNS vascular autoregulation and makes the Dx of Malignant HT definitive"

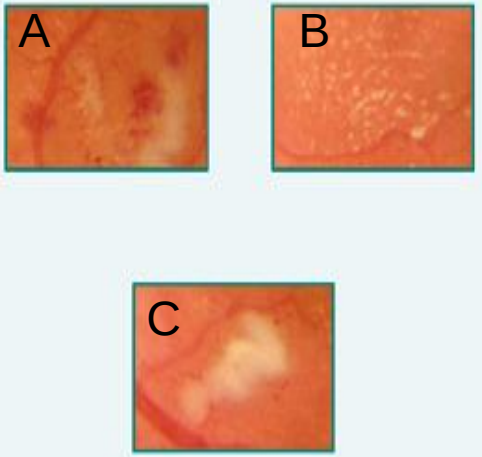
Retina Normal and Hypertensive Retinopathy



Normal Retina

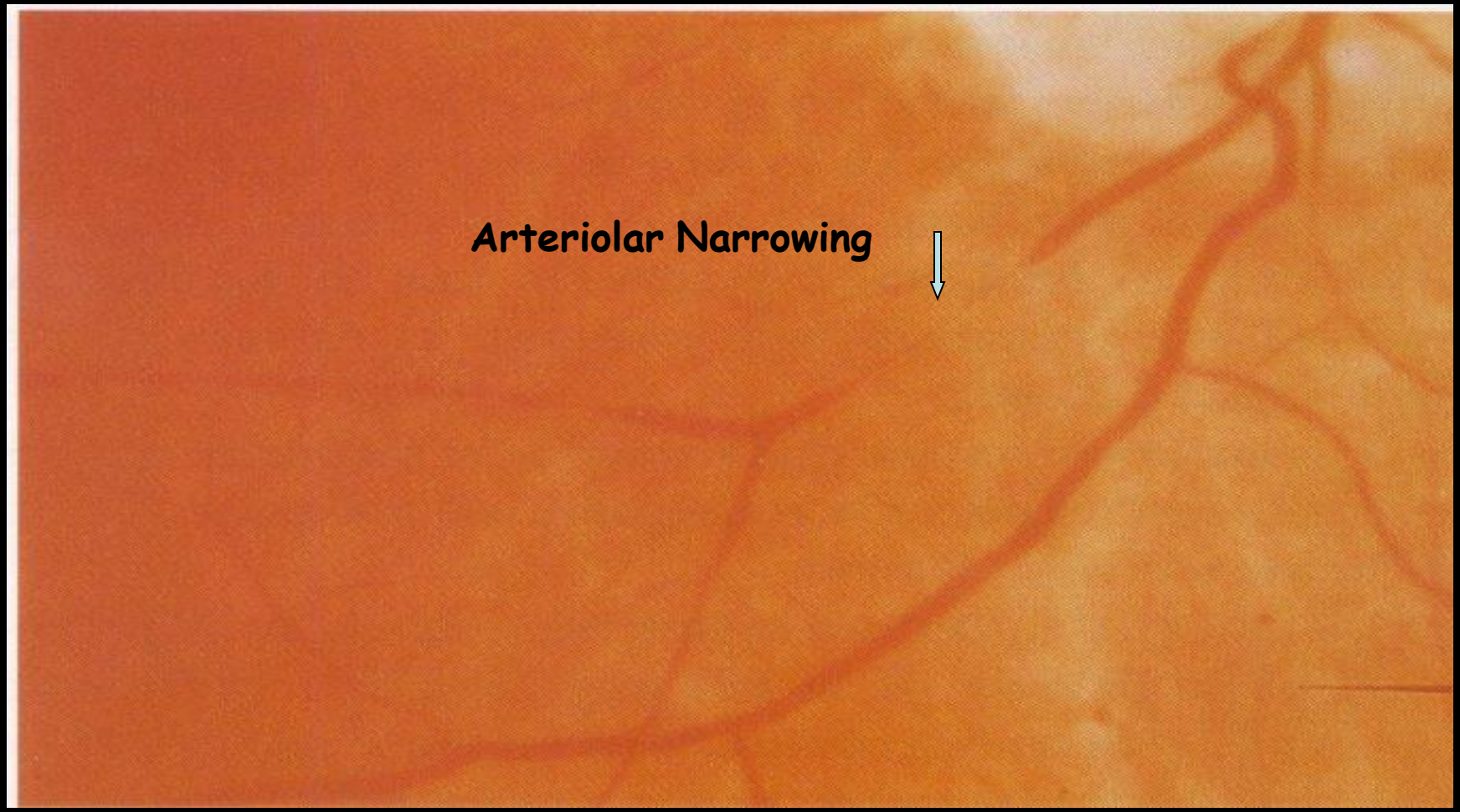


Hypertensive Retinopathy

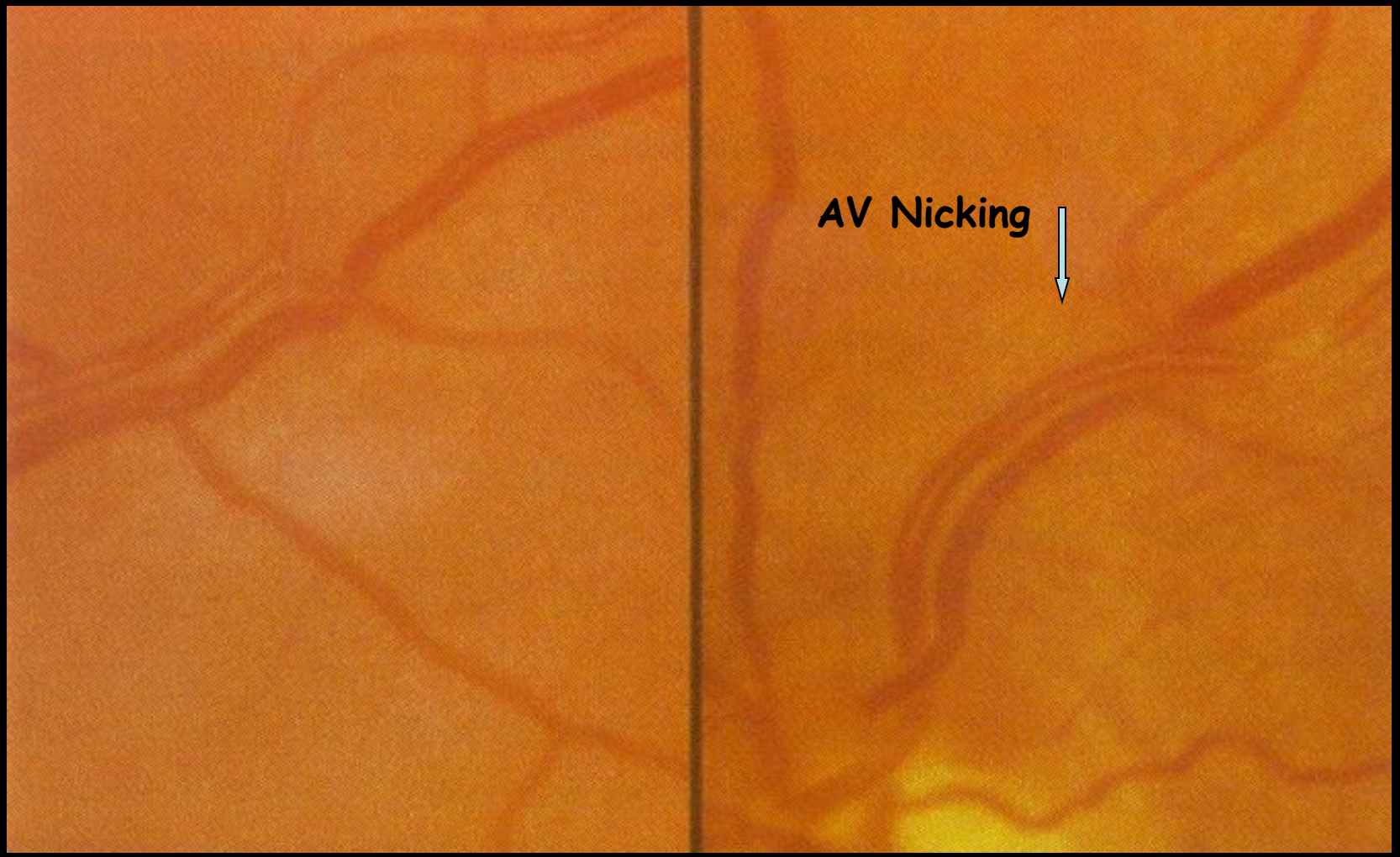


A: Hemorrhages
B: Exudates (Fatty Deposits)
C: Cotton Wool Spots (Micro Strokes)

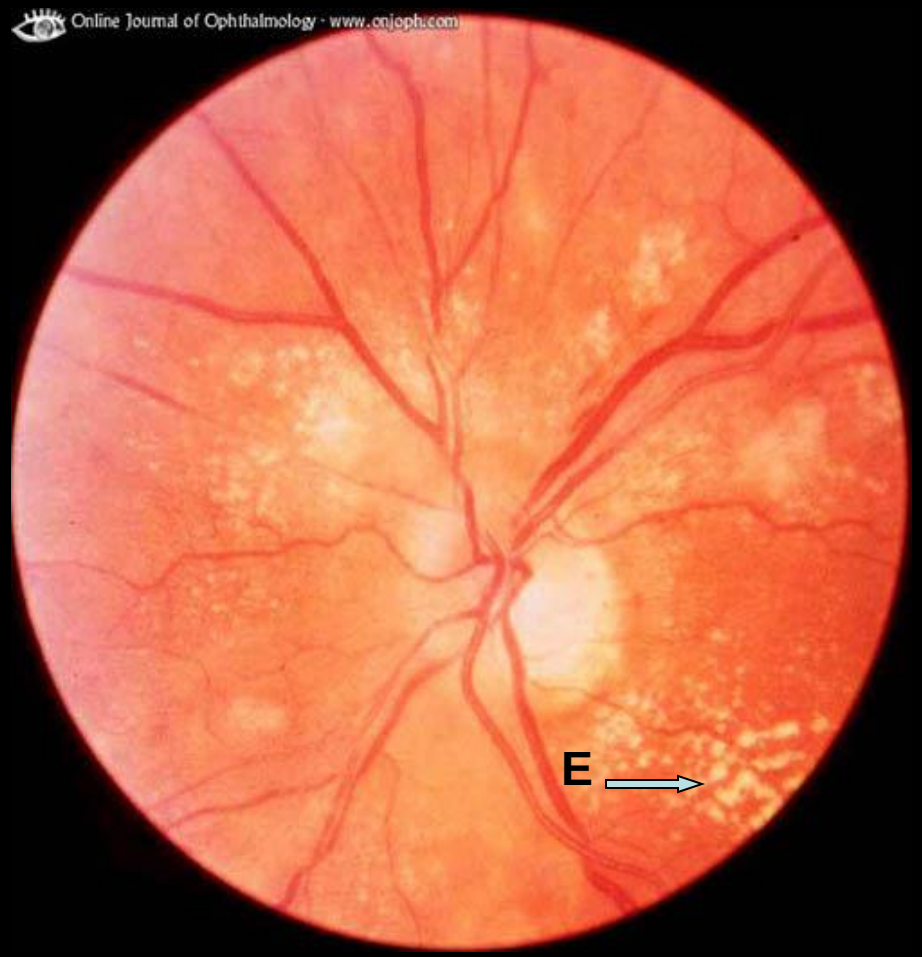
Stage-I Arteriolar Narrowing

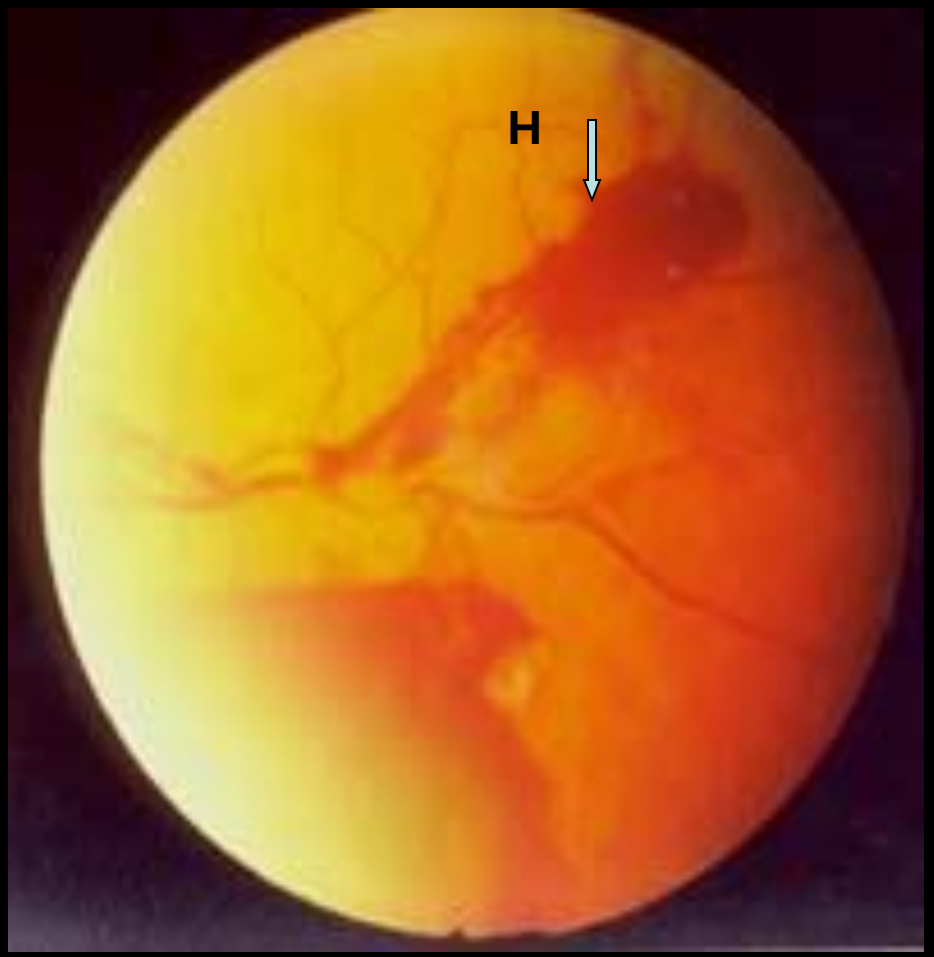


Stage-II AV Nicking



Stage-III Hemorrhages (H), Cotton Wool Spots and Exudats (E)





Stage-IV Stage III+Papilledema

Diagnosis

- **History**

1) **Focus on presence of symptoms of end-organ dysfunction**
2) **Any identifiable etiology**

- **Hypertension Hx**
  - Last known normal BP
  - Prior diagnoses
  - Dietary and social factors
- **Medication**
  - Steroid use
  - Estrogens
  - Sympathomimetics
  - MAO inhibitors
- **Social history**
  - Smoking, alcohol
  - Illicit drugs (cocaine, stimulants)
- **Family history**
  - Early HT in family members
  - Cardiovascular and cerebrovascular disease
  - Diabetes
  - Pheochromocytoma
- **Pregnant?**

Diagnosis

- **History (cont)**
- Symptom spesific Hx – suggesting EOD
- **CVS Hx**
  - Previous MI/angina/arrhythmias
  - Chest pain/claudication/flank or back pain
- **Neurologic Hx**
  - Prior strokes, neuro dysfunction
  - Visual changes, blurriness, loss of visual fields, severe headaches, nausea and vomiting, change in mental status
- **Renal Hx**
  - Underlying renal disease (RF)
  - Acute onset changes in renal frequency (anuria/oliguria)
- **Endocrine Hx**
  - Diabetes, thyroid dysfunction, Cushing's syndrome

Diagnosis

Examination

1) **Confirm elevated BP**
   - » **Proper position, appropriate cuff size**
   - » **Supine and standing and both arms**
2) **Asses – EOD present**

- **Fundoscopy**
  - Chronic HT will have findings
  - Acute changes
    - **New retinal bleeds**
      - Superficial/flame shaped
      - Deep/punctuate
    - **Exudates**
      - hard/cotton wool spots
    - **Papilledema**
- **Neck**
  - Enlarged thryoid, carotid bruit, jugular venous distention
- **CVS**
  - Enlarged heart, S3, asymmetric pulses, arrhythmias
- **Pulmonary**
  - Signs of LV dysfunction (crackles, rhonchi)
- **Renal**
  - Renal bruit, abdominal masses
- **Neurologic**
  - Level of consciousness, evidence of stroke, any focal signs

Workup

Lab studies

- Electrolytes, urea and creatinine
- Urinalysis – Dipstix + microscopy
- Optional - Tox screen
  - B-HCG
  - Endocrine testing

Imaging studies

- CXR (pulmonary edema, aortic arch, cardiac enlargement)
- Head CT/MRI brain (abn neurology)
- Chest CT/TEE/Aortic angio (Aortic dissection)

Other Tests

- ECG (LVH, signs of ischemia, injury, infarct)

Workup

- Aortic Dissection?
  - Suspect with severe tearing chest pain, unequal pulses, widened mediastinum
  - Contrast Chest CT Scan or MRI
- Pulmonary Edema/CHF
  - Transthoracic Echocardiogram
  - Differentiate between systolic dysfunction, diastolic dysfunction, mitral regurgitation

How Quickly?

- Cerebral Blood Flow Autoregulation
  - For constant Cerebral Blood flow in normotensive individuals MAPs of 60 -120 mmHg
  - In chronically hypertensive patients autoregulatory range is higher: MAP Range 120-160 mmHg
- Autoregulation also impaired in the elderly and those with cerebrovascular disease

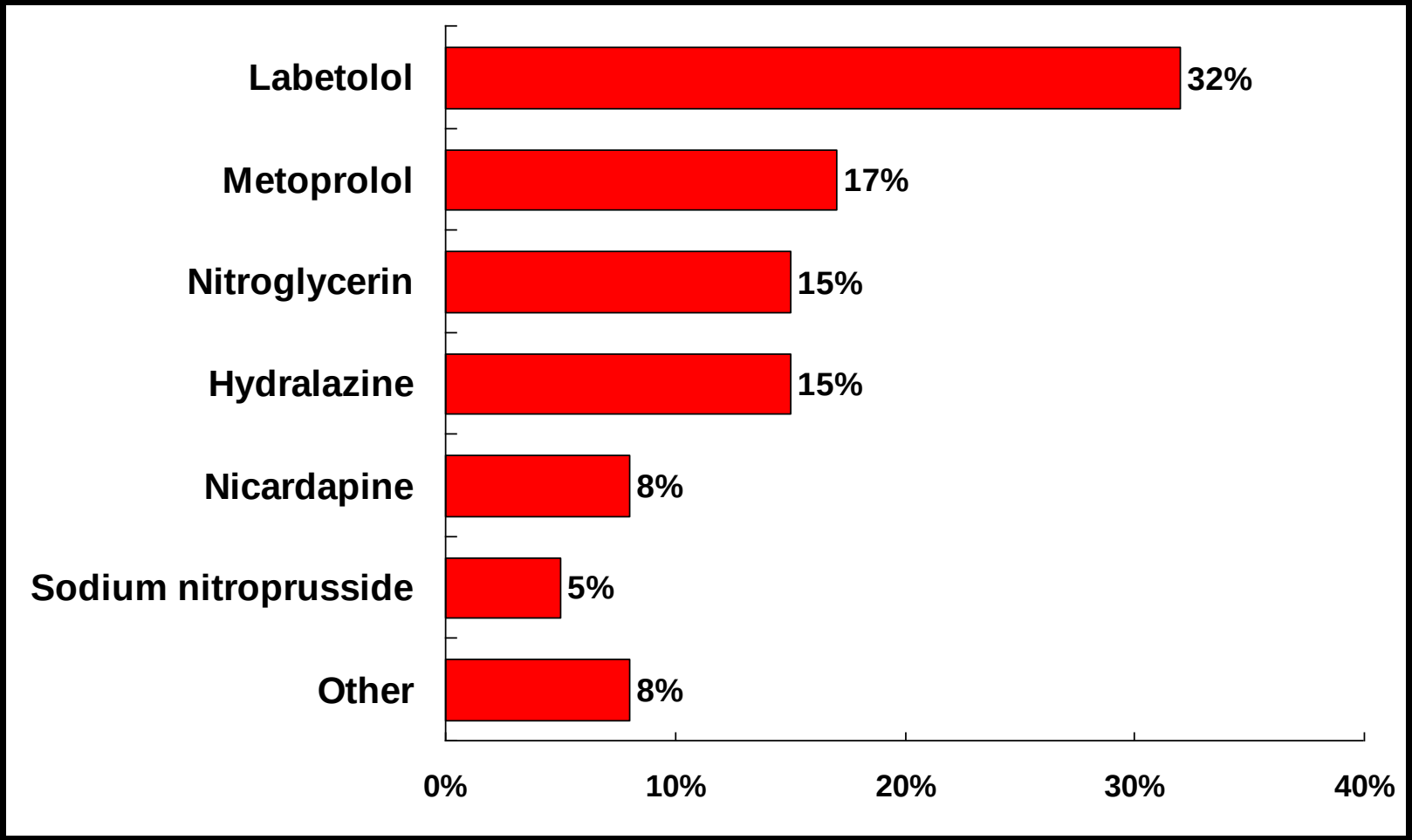
Management

- Where?
  - ICU with close monitoring
  - Severe cases require intra-arterial BP monitoring
- Which Parenteral meds?
- Depends on the situation
- In 2008: According to a Cochrane systematic review-there is no evidence that antihypertensive drugs reduced mortality or morbidity in hypertensive emergencies
- Therefore; treatment recommendations are consensus based

Treatment Typically Parenteral

- Adrenergic receptor blockers
  - Esmolol (β_1)
  - Labetalol (α_1 and β)
  - Phentolamine (α_1)
  - Urapidil (α_1)
- Ca^{2+} channel blockers
  - Nicardipine
  - Clevidipine
- ACE inhibitors
  - Enalaprilat
- NO donors
  - Nitroprusside
  - Nitroglycerin
  - Isosorbide dinitrate
- BNP analogue
  - Nesiritide
- Dopamine agonist
  - Fenoldopam
- Direct vasodilator
  - Hydralazine

What Is Used Most Commonly?



Katz et al. Am Heart J 2009;158:599-606

Specific Indications

Comorbidity	Preferred Agent(s)
Acute aortic dissection	Esmolol[b]
Acute congestive heart failure	Nesiritide,[c] nitroglycerin, nitroprusside
Acute intracerebral hemorrhage	Labetalol, nicardipine
Acute ischemic stroke	Labetalol, nicardipine
Acute myocardial infarction	Clevidipine,[d] esmolol, labetalol, nicardipine,[d] nitroglycerin
Acute pulmonary edema	Nesiritide,[c] nitroglycerin, nitroprusside
Acute renal failure	Clevidipine, fenoldopam, nicardipine
Eclampsia or preeclampsia	Hydralazine, labetalol, nicardipine
Perioperative hypertension	Clevidipine, esmolol, nicardipine, nitroglycerin, nitroprusside
Sympathetic crisis or catecholamine toxicity	Clevidipine, fenoldopam, nicardipine, phentolamine

[a]Agents listed in alphabetical order, not in order of preference.

[b]May be used in combination with a vasodilatorlike dihydropyridine calcium-channel blocker or nitroprusside; however, β-blockade must precede administration of these agents.

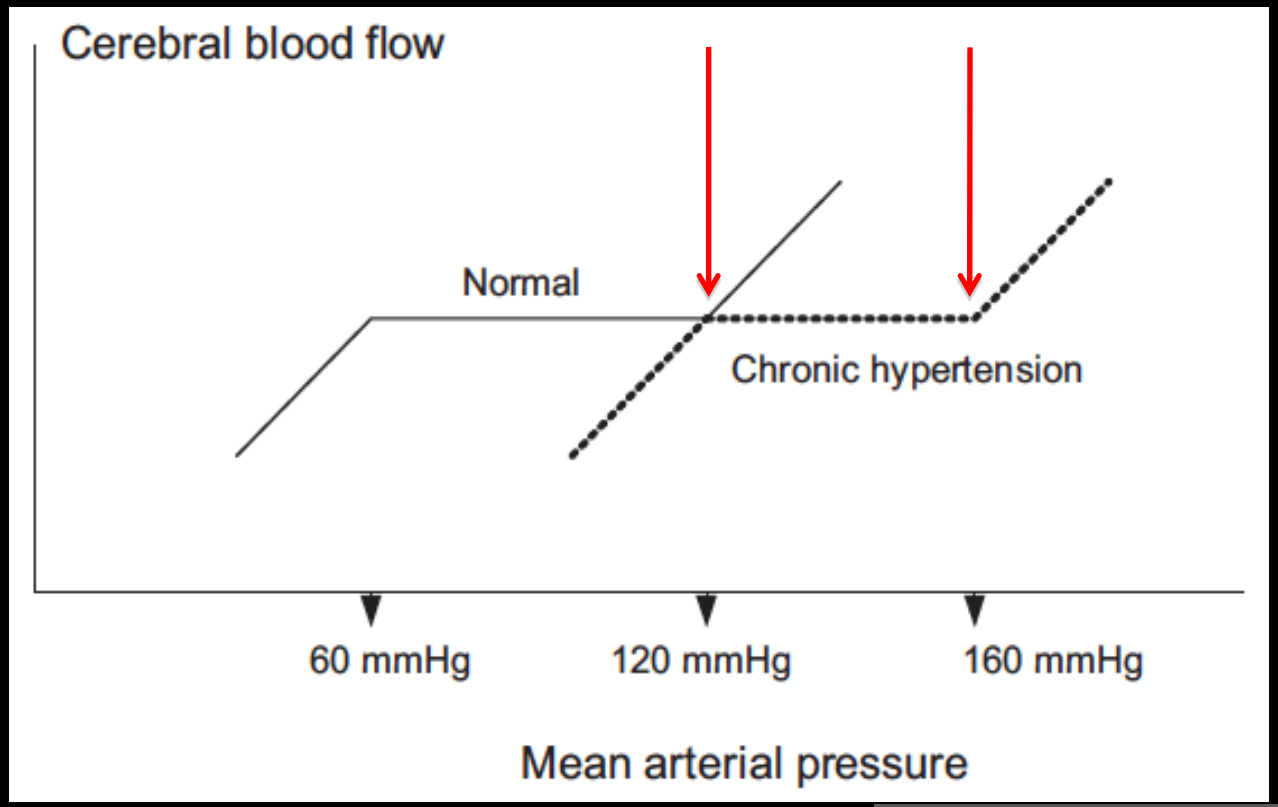
[c]Use is controversial.

[d]May be used in patients with heart rate of <70 beats/min.

Rhoney and Peacock. Am J Health-Syst PharmA. 2009; 66:1343-52

How Low Should You Go?

- Simple answer
  - 25% reduction in MAP within 1st hour
  - Target ~ 160/100 mmHg by 2-6 hours



Marik and Varon. Critical Care 2003, 7:374-84.

How Low Should You Go?

- Better answer
  - It really depends on clinical condition
    - Less aggressive with ischemic stroke
    - More aggressive with hemorrhagic stroke, acute HF and aortic dissection

AHA/ASA Recommendations for BP Management in AIS

1. Patients eligible for treatment with intravenous thrombolytics or other acute reperfusion intervention and SBP >185 mm Hg or DBP >110 mm Hg should have BP lowered before the intervention. A persistent SBP of >185 mm Hg or a DBP >110 mm Hg is a contraindication to intravenous thrombolytic therapy. After reperfusion therapy, keep SBP <180 mm Hg and DBP <105 mm Hg for at least 24 hours.
2. Patients who have other medical indications for aggressive treatment of BP should be treated.
3. For those not receiving thrombolytic therapy, BP may be lowered if it is markedly elevated (SBP >220 mm Hg or DBP >120 mm Hg). A reasonable goal would be to lower BP by approximately 15% during the first 24 hours after onset of stroke.
4. In hypotensive patients, the cause of hypotension should be sought. Hypovolemia and cardiac arrhythmias should be treated and in exceptional circumstances, vasopressors may be prescribed in an attempt to improve cerebral blood flow.

Aiyagari and Gorelick. Stroke 2009;40:2251-56

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AHA/ASA Recommendations for BP Management in ICH

1. If SBP is >200 mm Hg or MAP is >150 mm Hg, consider aggressive reduction of BP.
2. If SBP is >180 mm Hg or MAP is >130 mm Hg and ICP may be elevated, consider monitoring ICP and reducing BP to keep cerebral perfusion pressure between 60 and 80 mm Hg.
3. If SBP is >180 mm Hg or MAP is >130 mm Hg and there is no evidence of or suspicion of elevated ICP, consider modest BP reduction (eg, MAP of 110 mm Hg or target blood pressure of 160/90 mm Hg).

Aiyagari and Gorelick. Stroke 2009;40:2251-56

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AHA/ACC Recommendations for BP Management in Acute HF

The role of intravenous vasodilators for the patient hospitalized with HF can not be generalized. The goals of HF therapy with vasodilators, in the absence of more definitive data, include a more rapid resolution of congestive symptoms; relief of anginal symptoms while awaiting coronary intervention; control of hypertension complicating HF; and, in conjunction with ongoing hemodynamic monitoring while the intravenous drug is administered, improvement of hemodynamic abnormalities prior to instituting oral HF medications.

Hunt et al. Circulation. 2009;119(14):e391-479

Wrap Up

- Critical first step is to differentiate true emergencies from poorly controlled chronic hypertension
- Intervention for emergencies should be driven by condition-specific goals
  - Involve more than just a number!
  - Equate with problems caused by acute HT
  - Best achieved by using co-morbidity congruous agents

THANK YOU

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