Hypertensive Crises: Emergency and Urgency

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A PATIENT WITH HYPERTENSIVE CRISIS
Figure 1. Headlines of the *St. Louis Post-Dispatch*, April 13, 1945.

Reprinted with the permission of the *St. Louis Post-Dispatch*.
Figure 2. Diastolic and Systolic Arterial Pressure of Franklin D. Roosevelt from 1935 until His Death on April 12, 1945.

EKG denotes electrocardiogram, and LVH left ventricular hypertrophy. Data are from the diary of Dr. Howard G. Bruenn.²

Hypertensive Emergency and Chronic Hypertension: Clinical Context
Hypertension — An Epidemic

• **46%** = the prevalence of hypertension (as defined as SBP/DBP ≥ 130/80 or self-reported medication

• Affects at least 1 BILLION individuals worldwide

• Most current (2018) Guideline for the Prevention, Detection, Evaluation, and Management of High Blood Pressure in Adults—lacks evidence for acute management of patients presenting to an ED with hypertension, especially severe acute elevations of BP, and covers hypertensive crises in 3 pages (out of 122)

Hypertensive Crisis

Definition

• Arbitrarily defined as SBP >180 and/or DBP >120 mmHg.

• **Hypertensive Emergency**: severe blood pressure elevation complicated by acute end-organ deterioration.

• **Hypertensive Urgency**: severe blood pressure elevation in the absence of any acute end-organ deterioration.
However...The rate of rise of blood pressure is more important in precipitating end-organ damage than is the absolute level of blood pressure...Patients with longstanding poorly controlled hypertension can tolerate much higher blood pressures than patients who were previously normotensive.
Diagnosis

Hypertensive Emergency is distinguished from Hypertensive Urgency by history, physical exam, and laboratory evaluation—NOT by the level of blood pressure.
Hypertensive Emergency

CNS - encephalopathy, intracranial hemorrhage, Grade 3-4 retinopathy

Heart - CHF, MI, angina

Kidneys - acute kidney injury, microscopic hematuria

Vasculature - aortic dissection, eclampsia
Hypertensive Urgency

Diagnosis

Hypertensive Urgency may be associated “with severe headache, shortness of breath, epistaxis, or severe anxiety.”
Hypertensive Urgencies & Emergencies

- Epidemiologic data are largely lacking
- It is thought that ~ 1% of patients with hypertension will eventually present to the ED in hypertensive crisis
- In a single-center Italian study, HU or HE accounted for 3% of all medicine admissions and 27.5% of all medical emergencies
  - HU:HE ratio of 3:1 in that study
  - Patients with HU much more likely to be unaware of their hypertension diagnosis than those with HE

Hypertensive Crises – Key Points

• The diagnosis of hypertensive emergency is based more on the clinical state of the patient rather than on the absolute level of blood pressure *per se*.

• Sometimes the absolute level of blood pressure (i.e., >250/150 mm Hg), or the rate of rise of BP may constitute an emergency because of the risk of developing a poor outcome i.e. evolving aortic dissection.
Causes of Hypertensive Crises

- Essential hypertension
  - Medication non-adherence

- Secondary hypertension
  - Aortic coarctation
  - Cushing’s syndrome
  - Elevated ICP
  - Renal dysfunction
  - Pregnancy
  - Hyperparathyroidism
  - Hyperthyroidism
  - Pheochromocytoma
  - Primary aldosteronism

JNC 7, JAMA 2003; 289:2560-2572.
Hypertensive emergencies: Guideline consensus recommendations*

*Expert opinion

Hypertensive Urgency: Consensus Recommendations*

• Some patients may benefit from short-acting oral antihypertensive treatments
  – However, in one recent study, resting for 60 min was associated with ↓BP of >20% in 1/3 of patients
  – In addition, no evidence that failure to ↓BP in emergency department is associated with ↑short-term risk
  – Aggressive dosing with intravenous drugs or even oral agents, to rapidly lower BP is not without risk.

• Adjust or reinstitute antihypertensive regimen to gradually ↓BP over next few days

*Expert opinion

JNC 7, JAMA 2003; 289:2560-2572.
Hypertensive Urgency

Treatment Recommendations

• Gradual blood pressure reduction as an outpatient.

• Emphasis is on encouraging adherence to prescribed regimen.

• Immediate blood pressure reduction is not indicated.
Treatment Recommendations

- Resume therapy in patients who have not adhered to a prescribed regimen.
- Redose and adjust regimen in adherent patients.
- Initiate therapy in patients who have been previously untreated.
- Ensure near term follow up (24-48 hours)
Once the blood pressure is stabilized (outpatient), consider screening for secondary causes of hypertension if indicated.
Hypertensive Emergency
Hypertensive emergencies: Guideline consensus recommendations*

*Expert opinion

**Class I Recommendations**

- Hypertension emergency = admission to ICU for continuous monitoring of BP and for IV meds
- For adults with compelling conditions (dissection, eclampsia or pheo) SBP should be reduced to <140 during the first hour and to <120 in dissection
- Without a compelling indication, SBP should be reduced by no more than 25% during the first hour, then to 160/100 during then next 2-6 hours, then cautiously to normal over 24-48 hours
Nicardipine — Mechanism

• **Dihydropyridine Calcium Channel Blocker**
  – Inhibits calcium influx into vascular smooth muscle cells and myocardium
  – Peripheral and coronary vasodilation

• **Treatment Considerations**
  – Elimination $t_{\frac{1}{2}} = 40$ minutes
  – Clinical effect 15-20 minutes
  – 1-2 minutes to onset and easily titrated
  – Need effective BP monitoring
Nicardipine — Strategy

- Decreases SVR without producing tachycardia and augments cerebral blood flow
- Contraindicated with severe aortic stenosis
- Indications
  - Hypertensive emergencies (go to drug)
- Dose
  - IV drip @ 5 mg/hour
  - Increase by 2.5 mg/hour every 5-15 minutes
  - Max rate of 15 mg/hour
  - Convert to oral CCB once blood pressure controlled
Labetalol — Mechanism

- Competitive, selective $\alpha_1$ and non-selective $\beta$-blocker
  - $\beta > \alpha$ blockade (4-8 X’s more)
  - $\alpha$ blockade is 1/10 of clonidine
  - $\beta$ blockade is $\frac{1}{4}$ propranolol

- Treatment Considerations
  - Elimination $t\frac{1}{2} = 8$ hours:
    Clinical effect ~ 4-6 hrs
  - 5%: orthostatic hypotension
  - Paradoxical HTN with low doses
    ($\beta$ block only, unopposed $\alpha$)
Labetalol — Strategy

- No Δ in CBF: ↓. Good if h/o cerebrovascular disease
- No ↑ in HR: ↓. MV0₂ unchanged

• Indications
  - Catechol’ excess: Pheo, MAOI emergencies, clonidine withdrawal
  - Pregnancy-induced HTN

• Dose
  - 20-40 mg IV, q 30 mins, max 300 mg
    - BP drops within 5 mins, max response in 10 mins
  - IV drip @ 2 mg/min (may start w/ 20 mg bolus)
  - PO 200 mg
Nitroprusside — Mechanism

- Spontaneously releases nitric oxide (NO)
- NO activates guanylyl cyclase, increasing cGMP
- cGMP activates myosin light chain phosphatase (MLCP)
- MLCP dephosphorylates myosin light chains
- Leads to relaxation
Nitroprusside

• Arterial and venodilator
  – Decreases preload and afterload
  – No chronotropic effect, but HR $\uparrow$ (baroreceptors)

• Onset 1-2 minutes, $t\frac{1}{2}$ 3-4 minutes
  – Start @ 0.5 $\mu$g/kg/min, then titrate
  – Average effective dose is 3 $\mu$g/kg/min (0.5-10 $\mu$g/kg/min)
Nitropusside: Issues and Concerns

- ↓BP
- May cause N/V, twitching, sweating
- Metabolized to CN, then thiocyanate
  - RF issue
- BADNESS
  - Pregnancy
  - Coronary steal?
  - Dose dependent ↓ in CBF
    - Caution with high ICP
  - Hypoxia (↑ Va/Q mismatch)
  - Requires special delivery system
  - Usually requires direct artery pressure monitoring
Cyanide Toxicity

- **Tachyphylaxis** — Important sign of impending toxicity (toxicity rare at <200 μg/min)

- **Neurological manifestations**
  - Hyperpnea
  - Headache, Vertigo
  - Altered mental status
  - Coma, Seizures
  - Cardiac arrest

- **Laboratory manifestations**
  - Lactic acidosis
  - Increased base deficit

Nitroglycerin

• Arterial and coronary venodilator
  – Mechanism: cGMP
• Onset, 2-5 minutes, t ½ 4 minutes
  – Duration, 5-10 minutes
• Dose: Start at 20-30 μg/min
  – Titrate by 10 μg/min q 3-5 minutes
• May cause headache, ↑HR, vomiting, methemoglobinemia
• Special considerations
  – Tachyphylaxis within hours
  – Coronary ischemia
• IV form requires special delivery system

## Nitroprusside versus Nitroglycerin

<table>
<thead>
<tr>
<th>Drug</th>
<th>Nitroprusside</th>
<th>Nitroglycerin</th>
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</thead>
<tbody>
<tr>
<td>Rapid onset of peak effect</td>
<td>++++</td>
<td>+++</td>
</tr>
<tr>
<td>Afterload reduction</td>
<td>++++</td>
<td>+</td>
</tr>
<tr>
<td>Preload reduction</td>
<td>++</td>
<td>++++</td>
</tr>
<tr>
<td>Coronary steal reported</td>
<td>+</td>
<td>0</td>
</tr>
<tr>
<td>Coronary dilation – large vessel</td>
<td>+</td>
<td>++++</td>
</tr>
<tr>
<td>Coronary dilation – small vessel</td>
<td>+/-</td>
<td>+/-</td>
</tr>
<tr>
<td>Tachycardia</td>
<td>++</td>
<td>++</td>
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<tr>
<td>Potential for symptomatic hypotension</td>
<td>++</td>
<td>+++</td>
</tr>
<tr>
<td>Ease of administration</td>
<td>++</td>
<td>+++</td>
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<tr>
<td>Cyanide toxicity</td>
<td>++++</td>
<td>0</td>
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Compelling Indications

• Aortic dissection = Labetalol
• Acute pulmonary edema = NTG or NTP
• Acute coronary syndromes = Labetalol, Nicardipine, NTG
• Acute renal failure = Nicardipine
• Eclampsia = Labetalol, Nicardipine
• Acute ischemic stroke and $>220/110$ = Labetalol
Summary

• Hypertension is the most important public health problem
• Fortunately crises are rare, and emergency is defined by acute end organ damage
• Think about adherence, interfering substances, and secondary causes
• True hypertensive emergencies deserve an ICU and an IV drug
• Most hypertension should be managed through appropriate outpatient follow up