Doctor, your patient’s BP is elevated!

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Talk Overview

- Background
  - Classification and approach to HTN in the ED
  - Enormous scope of the problem
  - Dramatic benefits of Tx
- Chronic HTN in the ED
  - Risk stratification
- Severe HTN in the ED
  - Assessment of acute target organ damage
  - Whether to treat

HTN in the ED: classification

HTN Emergencies

- Acute target organ damage
  - Heart
  - Kidneys
  - Brain
  - Retina
  - Aorta
  - Placenta

Chronic HTN

- No acute target organ damage

HTN in the ED: classification

- “Emergencies e/b HTN”
  - Acute CHF
  - MI/ACS
  - Stroke
  - Ao dissection
  - Eclampsia

- “Malignant HTN”
  - Encephalopathy
  - Severe retinopathy
  - Acute nephropathy
**HTN in the ED: classification**

**Chronic HTN**
- **High risk**
  - Usually severe BP elevation
  - Prior target organ damage, multiple CV comorbidities
- **Low risk**
  - Mild to severe BP elevation
  - Young, limited comorbidities

**HTN in the ED: classification**

<table>
<thead>
<tr>
<th>HTN Emergencies</th>
<th>Chronic HTN</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;Emergencies a/b HTN&quot;</td>
<td>High risk</td>
</tr>
<tr>
<td>&quot;Malignant HTN&quot;</td>
<td>Low risk</td>
</tr>
</tbody>
</table>

**Pace of Treatment**

<table>
<thead>
<tr>
<th>minutes</th>
<th>hours</th>
<th>days</th>
<th>months</th>
</tr>
</thead>
</table>

**Approach to chronic HTN**

- **Mild to severe BP**
  - Repeat measurements
  - Hx of HTN?
  - Chronic HTN
- **Risk Stratify**
  - High Risk
    - Start or adjust rx
    - Early referral
    - Personal d/c instructions
  - Low Risk
    - Appropriate f/u

**Approach to possible HTN emergency**

- **Severe BP**
  - or
  - Sick or altered patient
  - Assess for acute target organ damage
    - present
    - absent

- **HTN emergency**
  - Immediate treatment
  - Admit

- **Chronic HTN**
HTN etiologies

- Essential HTN (95%)
- Secondary HTN
  - Renal artery stenosis
  - Pheochromcytoma
  - Primary hyperaldosteronism
  - Coarctation
  - Chronic renal disease
  - Acute GN, HUS / TTP, CTD’s (scleroderma), cyclosporin
  - serotonin syndrome, sympathomimetics, withdrawal states
- Young
- Accelerated/malignant
- Refractory

Complications

- Stroke & dementia
- CAD
- CHF
- Renal failure
- Aortic, carotid, peripheral vasc. dz

Risk doubles for each 20/10 ↑

HTN in the U.S.

- 27-31% of adults (over 18); 60% of adults over 60

- 16,095 US adults sampled
- 27% had HTN
  - 77% not controlled
- Risk factors for lack of awareness or control
  - Age > 65
  - Systolic hypertension
  - Hispanic
- >70% insured & under regular MD care

Hyman NEJM ‘01
Benefits of therapy

- Stroke: 0.6 (40% reduction)
- MI: 0.8
- CHF: 0.5
- ↓Renal failure
- Mortality: 0.9
  - NNT = 11 to prevent one death

Psaty JAMA ‘97  Chobanian JAMA ‘03

Where's the bang for your buck?
(relative vs. absolute risk reduction)

<table>
<thead>
<tr>
<th>Relative risk reduction (% reduction in strokes)</th>
<th>Absolute risk reduction (Strokes prevented in 100 pts tx’ed for 10 yrs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 year old, no DM or CV comorbidities</td>
<td>40%</td>
</tr>
<tr>
<td>72 year old, + comorbidities</td>
<td>40%</td>
</tr>
</tbody>
</table>

JNC VI. Arch Int Med ‘96

Where's the bang for your buck?
(absolute risk reduction)

<table>
<thead>
<tr>
<th>SBP 110</th>
<th>SBP 130</th>
<th>SBP 150</th>
<th>SBP 170</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>9</td>
<td>8</td>
<td>7</td>
</tr>
</tbody>
</table>

Jackson. Lancet 2005
BP in the ED: is it really HTN?

- Mild to severe BP
- Up to 28% of ED pts
- Chronic HTN
- Risk Stratify
- High Risk
- Low Risk

Pain
Fear
White coat
Intox
Withdrawal
Measurement issues

Systolic counts
- ~ 60% are currently on Rx for HTN
- In ~ 60% it is not sustained on multiple readings
- On average, DBP ~ 11.6 mm Hg
- 2 measurements 30 minutes apart
- Use sufficiently large cuff
- Must consider “white coat” phenomenon and pain
- Take a history!

Karras, Academ Emerg Med ’01
Reeves, JAMA ’95

The Highland BP screening card

<table>
<thead>
<tr>
<th>↑ DBP (multiple readings)</th>
<th>Persistent HTN @ F/U</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 90</td>
<td>49-69%</td>
</tr>
<tr>
<td>105-115</td>
<td>~70%</td>
</tr>
<tr>
<td>&gt;115</td>
<td>90-97%</td>
</tr>
</tbody>
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Backer Ann Emerg Med ’03
Reeves JAMA ’95
Chronic HTN in the ED

Patient on Rx, but BP ↑

The problem of noncompliance?

- 4783 pts
- HTN rx trials
- Electronic bottle caps

Vrijens. BMJ 2008

Chronic HTN in the ED

case 1

45 y/o AA woman w/ acute ankle injury
Triage BP 160/105
No PMH, no PMD
non-smoker
+FH of HTN (older sister, father)

Repeat BP (90 min later) 145/95
Ankle x-rays negative

Chronic HTN in the ED

case 2

61 y/o man c/o bilateral ankle swelling & requesting med refill. Triage BP 160/100
PMH: NIDDM (Off meds x 8 weeks, since “my doctor retired.”)
“small stroke” 5 yrs ago
Med: metformin
“I took a BP pill a few yrs ago”
Repeat BP 155/90. 1+ pedal edema. Exam o/w nl
Glu 280, Cr 1.4, CXR nl

Chronic HTN in the ED: should we treat?

Imperative to treat
• Nation-wide underdiagnosis
• Dramatic benefit of treatment
• Often lack of primary care

Problems w/ initiating Rx in ED
• Potential ED overdiagnosis
• Lifelong dx & Rx

Risk stratification
- Degree of elevation
- Comorbidities & cardiovascular risk
- Practice setting
- Availability of primary care
- ED resource utilization
**Approach to chronic HTN**

Mild to *severe* BP

- Repeat measurements
- Hx of HTN?

Chronic HTN

- **Risk Stratify**
  - High Risk
  - Start or rt rx
  - Early referral
  - Personal d/c instructions

- **Low Risk**
  - Appropriate f/u

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**Chronic HTN: risk stratification**

1. **Degree of elevation**
2. **Major CV risk factors**
   - Diabetes
   - Smoking
   - Dyslipidemia
   - Age > 60
   - Family hx
   - Male sex
3. Prior target organ damage/clinical CVD
   - MI/angina/revasc. hx
   - Cardiomyopathy
   - CVA/TIA
   - Nephropathy
   - PVD
   - Retinopathy
   - LV hypertrophy
4. **Age**

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**Examples of Moderate Hypertensive Retinopathy**

- Detection
  - Echo: LVH present in 19-48% of HTN pts
  - EKG: ~40% sensitive c/w Echo, but specific
  - EKG criteria
    - RaVL >11mm
    - SV1 + R(V5 or V6) >35mm
    - RaVL + SV3 > 28mm (men); > 20mm (women)

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**LVH**

- ~2 fold ↑ in MI, sudden death, stroke
- Detection
  - Echo: LVH present in 19-48% of HTN pts
  - EKG: ~40% sensitive c/w Echo, but specific
- **EKG criteria**
  - RaVL >11mm
  - SV1 + R(V5 or V6) >35mm
  - RaVL + SV3 > 28mm (men); > 20mm (women)

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*Devereux Eur Heart J ’93*
Cerebral small vessel dz (prior CNS target organ damage)

- Lacunar infarcts
- Periventricular white matter changes

Chronic HTN in the ED

*Case 1 revisited*

40 y/o woman w/ ankle sprain. No PMH, nonsmoker.
BP 145/95 (sustained)

- No Rx
- Arrange f/u
- Consider “BP card”

Chronic HTN: f/u & referral

<table>
<thead>
<tr>
<th>Systolic</th>
<th>Diastolic</th>
<th>F/u recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>130-139</td>
<td>85-89</td>
<td>Recheck within 1 year</td>
</tr>
<tr>
<td>140-149</td>
<td>90-99</td>
<td>Recheck within 2 months</td>
</tr>
<tr>
<td>160-179</td>
<td>100-109</td>
<td>Risk stratify &amp; treat (or insure primary care f/u) within 1 month</td>
</tr>
<tr>
<td>&gt;180</td>
<td>&gt;110</td>
<td>Risk stratify &amp; treat (or insure primary care f/u) immediately, or within 1 week</td>
</tr>
</tbody>
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JNC VI. Arch Int Med ’97
Chronic HTN in the ED

Case 2 revisited

61 y/o man med refill. NIDDM, hx CVA
BP 155/90 (sustained)

- Select & start Rx from ED

Treating chronic HTN from the ED…

take a deep breath

JNC VII - a paradigm shift

- Normal BP = < 120 / 80
- 120-139 / 80-89 = “prehypertension”
- SBP more important than DBP
- Tx threshold in DM and renal dz = 130 / 90
- Recommended initial Rx: thiazide diuretic
- For BP > 160 /110: begin with 2 drugs
- Second line meds
  - ACEI, ARB
  - β-blockers
  - Calcium channel blockers

JNC VII - a paradigm shift

<table>
<thead>
<tr>
<th>Classification</th>
<th>BP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>&lt; 120 / 80</td>
</tr>
<tr>
<td>Prehypertension</td>
<td>120-139 / 80-89</td>
</tr>
<tr>
<td>Stage 1</td>
<td>140-159 / 90-99</td>
</tr>
<tr>
<td>Stage 2</td>
<td>&gt; 160 / &gt;100</td>
</tr>
</tbody>
</table>

Stage 3 > 180/110
HTN urgency > 180/120

JNC VII. JAMA ’03
Chronic HTN: Tx Principles

- Once a day dosing
- Starting with 2 drugs is OK (HCTZ + ACEI)
- Comorbidities may guide choice:

<table>
<thead>
<tr>
<th>Comorbidity</th>
<th>Agent 1</th>
<th>Agent 2</th>
<th>Agent 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diabetes (esp. w/ proteinuria)</td>
<td>ACEI</td>
<td>β blocker</td>
<td>CACB (non-dihydropyridine)</td>
</tr>
<tr>
<td>Angina</td>
<td>ACEI</td>
<td>β blocker</td>
<td>CACB (non-dihydropyridine)</td>
</tr>
<tr>
<td>MI + ↓ LV fx</td>
<td>ACEI</td>
<td>Diuretic</td>
<td>CACB</td>
</tr>
<tr>
<td>CHF</td>
<td>ACEI</td>
<td>Diuretic</td>
<td>CACB</td>
</tr>
<tr>
<td>Elderly + ↑ SBP</td>
<td>Diuretic</td>
<td>CACB</td>
<td></td>
</tr>
</tbody>
</table>

Chronic HTN meds: HCTZ

- The ALLHAT trial
- N = 33,000; > 55; 1 CAD risk factor
- Chlorthalidone vs. amlodipine vs. lisinopril...5 yr f/u
- Primary outcomes: MI or death from CHD...no difference
- Secondary outcomes: Mortality, HF, CVA, CVD events combined...
  - Chlorthalidone vs. amlodipine: less HF w/ chlorthalidone
  - Chlorthalidone vs. lisinopril: less HF, less CVAs, less combined CVD events w/ chlorthalidone
- Editorialist: "Thiazide diuretics are the preferred initial therapy for HTN"

Chronic HTN meds: ACE inhibitors

- Your #1 go-to agent
- 12.5-25 mg qd
- Slower acting (~12 weeks for full effect)
- Mechanism not fully understood
- Efficacious in blacks and elderly
- Excellent in combination w/ ACEI
- Contraindications: hx of hyponatremia; gout
- Recheck BP and K+ in 2-4 weeks
- Starting dose: enalapril 5 mg, lisinopril 10 mg qd
- Preferred for CHF, post MI + ↓ LV fx, DM + proteinuria,
- HOPE trial - ramipril vs. placebo
  - 9000 pts w/ CVD or DM, w/out HTN or ↓ EF
  - Ramipril group: less CVA, MI, CVD death
- Less BP reduction alone, esp. in blacks
  => combine w/ HCTZ (potent combo)
- Expect ↑ Cr of ~ 0.5; withhold for Cr > 3
- Cough (10%), angioedema
- Contraindicated in pregnancy

- Yusuf. NEJM ‘00

ALLHAT. JAMA ‘03
Appel. JAMA ‘03
Chronic HTN meds
- Angiotensin II receptor blockers (ARBs)
  - Expensive
  - Recommended for pts w/ ACEI cough
  - LIFE trial: c/w atenolol, for same BP ↓
    additional ↓ CVD morbidity and mortality
- Calcium channel blockers
  - Efficacious for BP ↓
  - Excellent ↓ in CVA incidence
  - Possibly less ↓ in CAD

Dahlof, Lindholm. Lancet ‘02

Chronic HTN: pt education
(when starting Rx from ED)
- “Lifelong diagnosis”
- “lifelong medicines”
- “silent disease”
- Prevention of “sudden heart attack and stroke”
- Empathy

Malignant HTN & severe HTN in the ED

HTN emergencies
- “Emergencies complicated by HTN”
  - Aortic dissection
  - MI/ACS
  - Pulmonary edema
  - Acute ICH
  - Eclampsia

“Malignant HTN”
- Accelerated nephropathy
- Gr IV retinopathy
- Encephalopathy
Malignant HTN: accelerated nephropathy

**Pathophys:**

- Renin-angiotensin / BP
- Necrotizing arteriolitis
- Intravascular thrombosis
- Proteinuria, hematuria, azotemia, a/w retinopathy

**Clinical definition**

- Not well defined
- "Cellular urinary sediment and significant Cr rise"
- Severe HTN + Cr > 1.2 or 25% above baseline
- If associated with longstanding HTN, encephalopathy usually absent

Karras Academ Emerg Med '02

Malignant HTN: encephalopathy

- Associated with secondary causes of HTN / recent severe BP elevation (young pt w/ GN or CTD)
- Pathology: posterior leukencephalopathy (vasogenic edema on MRI)
- Lethargy, Sz, confusion, HA, visual disturbances
- R/o cocaine intox, EtOH w/drawal
- Head CT - r/o ICH, mass
- Confirmatory fundoscopy
  - Gr 3-4 changes &/or papilledema

Malignant HTN: grade 4 retinopathy

Severe HTN in the ED

Case 1

41 y/o man c/o headache, low back pain
PMH: HTN (took meds while in prison)
Med: none   Hab: regular EtOH, occ cocaine

BP 240 / 115  HR 80  R 22  afebrile  SpO2 98%
Muscular man, appears comfortable
S4 gallop, trace pedal edema
Exam otherwise normal

UA: 1+ pro, trace RBC’s, o/w nl
Repeat BP (30 min later): 210/110

Severe HTN in the ED: approach

- Severe BP ↓ or sick or altered patient
- Assess for acute target organ damage:
  1. Ischemia, CHF
  2. Nephropathy
  3. Encephalopathy, TIA, CVA
  4. Severe retinopathy

- HTN emergency
- Chronic HTN

Assessment for acute target organ damage: the heart

- Severe HTN + cardiac ischemia or CHF
  - CP or hx of anginal sx?
  - SpO2, signs of CHF, edema
  - EKG
  - +/- CXR
  - +/- troponin (yes if elderly), +/- BNP

- Treatment for this HTN emergency:
  - IV nitroglycerin, morphine, anxiolytic, +/- β-blocker,
  - +/- ACEI (nitroprusside rarely required)

Malignant HTN: management

- Challenge is diagnosis
- Admission required
  - W/u of secondary causes
  - Confirm efficacy of Rx regimen
- Immediate parenteral therapy
  - Labetalol, nicardipine, nitroprusside, fenoldopam
  - MAP ↓ 15-25%; or 160/100
  - Sometimes unwarranted in ED (opinion)

Confirm efficacy of Rx regimen
Immediate parenteral therapy
MAP 15-25%; or
Immediate treatment Admit

Severe HTN in the ED

1. Ischemia, CHF
2. Nephropathy
3. Encephalopathy, TIA, CVA
4. Severe retinopathy
Assessment for acute target organ damage:

**acute nephropathy**
- Work up all severe ↑ BP with no recent creatinine
  - Serum Cr (compared with prior levels)
  - UA for protein and microscopy
- What constitutes nephropathy needing admission?
  - Severe HTN + Cr rise > 25%
  - Severe HTN + Cr > 2 with no baseline for comparison
  - Consider urinary findings (RBCs, RBC casts, 3+ proteinuria)

*LITTLE EVIDENCE*

Karras Academ Emerg Med ´02

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Assessment for acute target organ damage:

**the brain & retina**
- Work-up severe HTN + any neuro sx (+/- HA)
  - Careful hx for TIA sx, etc
  - Careful neuro exam, incl gait
  - Fundoscopy
  - Very low threshold for head CT
    - hemorrhage, mass, lacunar infarcts
- R/o occult stroke before treatment decision

*LITTLE EVIDENCE*
Severe HTN in the ED

**case 1 revisited**

41 y/o man c/o with nonspecific sx, incl HA

Serial BPs: 240/115 (triage), 210/110, 200/115
Carefull neuro exam: normal
fundoscopy: + marked AV nicking

UA: 1+ pro, trace RBC's, o/w nl;
Urine tox screen: neg cocaine
Cr 1.6 (no baseline)
EKG: NSR, LVH, no ST/T abnl
Head CT: normal

Severe HTN in the ED

**His nurse asks, “Can we give him something now to bring his BP down?”**

Severe HTN in the ED: approach

- Severe BP or sick or altered patient
- Assess for acute target organ damage
- HTN emergency
- Immediate treatment
- Admit
- “Severe HTN in the ED”
- “Hypertensive urgency”
- Personal d/c instructions

Severe HTN in the ED

- Various definitions: >180-220 / 110-120
- 10% of HTN population
  - Huge ↑ CVD morbidity
  - 5% of pts in urban, teaching ED's
  - 98% have known hx of HTN
- Frequently
  - Lack primary care
  - Get Rx filled in ED
  - Non-compliant w/ Rx
  - Alcohol and recreational drug use

**Severe HTN in the ED: presentation**
- 1/3 referred from outpt setting
- 10% acute intoxication or withdrawal
- 2/3 asymptomatic or nonspecific sx
  - HA
  - Musculoskeletal
  - Atypical CP
  - Dizzy
  - Epistaxis
  - Blurred vision

Preston J Hum Hypertens ’99

**Severe HTN in the ED: natural history**
- BP > 180-220/115
- Full evaluation
- 20-36% Acute target organ damage
- 64-80% No acute target organ damage
- Treated in ED
  - MAP ↓21 mmHg
- Discharged
- Untreated
  - MAP ↓11 mmHg

Preston J Hum Hypertens ’99

- • 50% complied with scheduled f/u
- • 30% returned within 3 mo w/ severe HTN

**Untreated severe HTN: natural history**
- RCT of HTN Tx. VA cooperative study, 1967
- 70 pts, mean age 50, DBP 115-129, mean SBP 187...randomized to placebo!
- Outcomes after 1-3 years
  - 24 (34%) HTN-related adverse events
    - CHF(4), CVA(4), MI/sudden death(3), renal failure(3), Ao dissection (2), progressive retinopathy (lots)
  - 3 events occurred at month 4, none before
- Adverse events in treated group: 3%

VA Coop. JAMA ’67

**Severe HTN in the ED case 1 concluded**
- 41 y/o man w/ nonspecific symptoms & severe HTN
- Mild retinopathy, LVH, ? nephropathy
- No acute target organ damage
- D/C home with Rx in hand
- HCTZ 25 mg + Lisinopril 10 mg QD
- F/u urgent care 1 week; new PMD appt 2 weeks
- Intensive pt education
- (level 5 billing)
Severe HTN in the ED  
**case 2**

72 y/o Chinese woman, BIB family c/o dizziness and fatigue for 2 d.
PMH: longstanding HTN, o/w none
Med: Atenelol, HCTZ
BP 200/110 62 18 afeb RA SpO2 98%
Unremarkable Neuro: documented as normal (No fundoscopy)

Repeat BP: 190/110
EKG: unchanged from prior
Cr 1.4 (prior 1.2; 16% ↑)
Troponin #1 nl
Dx: “hypertensive urgency; r/o ACS”
Dispo: “likely D/C, awaiting 2nd troponin”
Tx: atenolol po, HCTZ po, then hydralazine 10mg IV x 3
BP -> 130/80 (22% ↓ MAP)

Severe HTN in the ED  
**case 2 head CT**

Admitted to ICU, eventual labetelol drip

Incomplete w/u Incorrect dx Overly aggressive tx

Severe HTN in ED  
**case 3**

89 y/o woman recently returned from India, c/o dizziness, weakness x 1d.
PMH: DM, HTN
Med: glyburide, losartan
BP 250/120 85 20 afeb RA SpO2 97%
unsteady gait (requires cane) otherwise nl (no fundoscopy)
EKG: “ant-lat T wave inversion” (no old for comparison)
Severe HTN in ED

*case 3 continued*

**DDx:** metabolic abnl, UTI, PNA, ACS, doubt CNS pathology

**Orders:** labs, serial trop’s, CXR, CT head, enalapril 20 mg po, hydralazine 20 mg IV

“BP improved” 170/90 (30% MAP ↓)

Troponins: 0.06 -> 2.56 -> 3.41

Overly aggressive tx Tx before w/u returns Caused an NSTEMI?

Take home messages

- HTN is underdiagnosed & undertreated in US
- HTN is prone to overdiagnosis in ED
- Chronic HTN:
  - Risk stratification & absolute risk reduction
  - HCTZ
- Malignant HTN / encephalopathy
  - Dx requires neg. head CT & positive fundoscopy or significant new renal impairment
- Severe HTN without acute target organ damage = chronic HTN; do not treat acutely in ED

**HTN in the ED: approach**

- Severe BP & or sick or altered patient
- Assess for acute target organ damage
  - present
    - HTN emergency
  - absent
    - Chronic HTN (generally high risk)
- "Hypertensive Urgency" Oral BP & go
HTN in the ED: approach

**Severe BP ‡ or sick or altered patient**

Assess for acute target organ damage

- Present:
  - HTN emergency
  - Immediate treatment
  - Admit

- Absent:
  - Chronic HTN (generally high risk)
  - Start or ‡rx
  - Early referral
  - Personal d/c instructions

**Chronic HTN Emergency**

**Take home messages**

- HTN is underdiagnosed & undertreated in US
- HTN is prone to overdiagnosis in ED
- Chronic HTN:
  - Risk stratification & absolute risk reduction
  - HCTZ
- Malignant HTN / encephalopathy
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- Severe HTN without acute target organ damage = chronic HTN; do not treat acutely in ED

HTN in the ED: approach

**Severe BP ‡ or sick or altered pt**

Assess for acute target organ damage

- Present:
  - HTN Emergency
  - Admit & immediate tx

- Absent:
  - Chronic HTN
    - Repeat measurements
    - Risk stratify
      - High risk
        - Start Rx, usually D/C, early referral
      - Low risk
        - D/C & refer ‡ start Rx

**Autoregulation of cerebral blood flow**

- CBF
- MAP

- Autoregulation failure
HTN emergencies
Sodium Nitroprusside (SNP)
- Direct vascular smooth muscle relaxation
- T 1/2 ~ 1 min (immediate onset, highly titratable)
- Tried and true
- Theoretic problems:
  - cerebral and coronary steal
  - ↑ ICP
- Adverse effects:
  - Thiocyanate toxicity - an issue in renal failure
  - Cyanide toxicity

HTN emergencies
Labetalol
- Mechanism: β and α blockade (7:1)
- t 1/2 = 6 hrs (onset 5-10 min, duration ~2 hrs)
- Initial BP ↓ “titratable”, but not reversible
- Ease of dosing: 20-80 mg q 10 min (max 300 mg)
- Favorable CNS effects
- Large experience in many centers
- Adverse affects
  - Heart block
  - Bronchospasm
  - Paradoxical hypertension (w/ sympathomimetics)

HTN emergencies
Fenoldopam
- Dopamine 1 receptor agonist
  → arteriolar vasodilation
- t 1/2 = 10-15 min (onset 5-10 min; duration 10-15 min)
- Comparable efficacy, titratability to SNP
- Beneficial renal affects (↑ RBF/diuresis)
- Adverse effects
  - Overall frequency comparable to SNP
  - HA, flushing, dizzy, tachy, brady, T wave ∆
  - ↑ IOP

HTN emergencies
Nicardipine
- “IV nifedipine”
- Kinetics similar to labetelol, ie, not truly titratable
  - Duration 30 min - 3 hr
- Drip required
  - 5 mg/hr
  - Adjust ↑ 2.5 mg/hr q 5 min
- No ED studies; limited ED experience
**HTN emergencies**

- Oral short-acting nifedipine
  - Notoriously unsafe
  - Unpredictable, precipitous, irreversible BP ↓
  - Steal phenom. and reflex tachy/catechols
  - Stroke, MI, death reported
- Oral clonidine…same story?

Grossman JAMA ‘96

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**HTN Emergencies:**

**CVA + HTN**

- Ischemic CVA - in general, do not treat
  - Consider for BP > 220/130
  - For TPA: maintain < 185/110
- SAH - in general, do not treat
  - Consider for BP > 220/130
  - BP reduction prior to clipping/coiling is controversial
    - Labetalol or nitroprusside
- Nimodipine - usually not an ED issue
- Intraparenchymal hemorrhage (BP>200/120)
  - MAP < 20 % recommended
    - Labetalol or nitroprusside

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**HTN emergencies**

- "Emergencies complicated by HTN"
  - Aortic dissection
  - MI/ACS
  - Pulmonary edema
  - Acute ICH
  - Eclampsia
- "Malignant HTN"
  - Accelerated nephropathy
  - Gr IV retinopathy
  - Encephalopathy

---

**HTN Emergencies:**

**MI / ACS + HTN**

- Nitroglycerine
  - Sublingual
- NTG drip - 100 ug/min
- Beta-blocker
  - Metoprolol 5-15mg IV
- Morphine
- ACEI
  - Captopril 6.25-12.5mg sublingual
- Nipride
### HTN emergencies: pulmonary edema
- Nitroglycerine
- Sublingual
- NTG drip - 100 ug/min
- MSO4
- ACEI
  - Captopril 6.25-12.5mg sublingual
- Nipride

### HTN emergencies: aortic dissection
- Goal: systolic < 120; minimize dP/dT
- Beta-blocker
  - Propranolol
  - Metoprolol
  - Esmolol
- Vasodilator (after β-blocker)
  - Nitroprusside
  - Fenoldapam

### HTN emergencies: eclampsia
- Delivery
- Sz control / MgSO4
- Hydralazine
  - For diastolic > 110
  - 5 mg IV q 20 min → 20 mg

### HTN emergencies in the ED

<table>
<thead>
<tr>
<th></th>
<th>33</th>
<th>28</th>
<th>15</th>
<th>12</th>
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<td>Hydralazine</td>
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</tbody>
</table>

Tumlin et al. Acad Emerg Med ’00
Multicenter ED study of fenoldapam in HTN emergencies
N=107 (21 centers, 1 yr)

Karras et al. Acad Emerg Med ’02
ED study of severe HTN and azotemia
N=143; 45 HTN emergencies
**Chronic HTN: risk stratification**

- 40 y/o woman w/out PMH, nonsmoker
  - BP 145/95 (sustained)
  - NNT (5yrs; to prevent CV event) > 150
- 61 y/o man w/ NIDDM, hx CVA
  - BP 160/90 (sustained)
  - NNT < 10

**Benefit of therapy**

<table>
<thead>
<tr>
<th>Relative Benefit (vs. placebo)</th>
<th>Absolute Benefit (Strokes prevented per 1000 pt yrs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relative Benefit (%) reduction in stroke</td>
<td>Absolute Benefit (Strokes prevented per 1000 pt yrs)</td>
</tr>
</tbody>
</table>

**HTN in the ED: approach**

- Severe BP elevation or ill or altered patient
  - Assess for acute target organ damage
    - Present
      - HTN Emergency
        - Admit & immediate tx
    - Absent
      - Chronic HTN
        - Risk stratify
          - High risk
            - Start Rx, usually D/C, early referral
            - D/C & refer, +/- start Rx
          - Low risk
            - Repeat measurements

**Chronic HTN in the ED**

- Severe BP elevation
  - No evidence of acute target organ damage
  - Repeat measurements & Hx
- Mild & mod. BP elevation
  - Repeat measurements
  - Chronic HTN
  - Risk stratify
    - High Risk
      - Treatment?
    - Low Risk
### HTN classification

**JNC VI 1997**

<table>
<thead>
<tr>
<th>Classification</th>
<th>BP</th>
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<tbody>
<tr>
<td>Normal</td>
<td>&lt;130/85</td>
</tr>
<tr>
<td>High normal</td>
<td>130-139/85-89</td>
</tr>
<tr>
<td>Stage 1</td>
<td>140-159/90-99</td>
</tr>
<tr>
<td>Stage 2</td>
<td>160-179/100-109</td>
</tr>
<tr>
<td>Stage 3</td>
<td>&gt;180/&gt;110</td>
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</table>

**JNC VII 2003**

<table>
<thead>
<tr>
<th>Classification</th>
<th>BP</th>
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<tbody>
<tr>
<td>Normal</td>
<td>&lt;120/80</td>
</tr>
<tr>
<td>Prehypertension</td>
<td>120-139/80-89</td>
</tr>
<tr>
<td>Stage 1</td>
<td>140-159/90-99</td>
</tr>
<tr>
<td>Stage 2</td>
<td>&gt;160/&gt;100</td>
</tr>
</tbody>
</table>

JNC VI. Arch Int Med ’97  
JNC VII. JAMA ’03

### Chronic HTN meds: β-blockers losing favor as 1st choice Rx

- β-blocker monotherapy, new data:
  - Achieves 1/2 the CVA reduction of other classes
  - May not reduce MI or mortality
- β-blockers (atenolol 25mg, metoprolol 50mg qd):
  - Preferred for post MI, angina
  - Contraindications: asthma, heart block
  - Fatigue/exercise intolerance
  - Avoid for initial monotherapy (unofficial rec)

Dahlof. Lancet ’05  
Lindholm. Lancet ’05

### Severe HTN in the ED: recommended approach

Severe BP elevation >180/110

Assess for acute target organ damage:

- present
- absent

HTN Emergency  
Chronic HTN  
Risk stratify

### Assessment for acute target organ damage: the retina

- Flame haemorrhage
- Hard exudates
- Papilledema
- Cotton Wool Spot
Severe HTN in the ED: recommended approach

- Severe BP elevation >180/110
  - Assess for acute target organ damage
  - Absent vs. present

- HTN Emergency
- Chronic HTN
- Risk stratify

Prevalence

- Up to 28% of pts have ↑ BP reading
  - 40% sustained (multiple readings)
  - 70% have hx of HTN
  - 60% on Rx
  - 50% is systolic HTN (DBP ≤ 90)

Karras, Academ Emerg Med ’01

BP measurement: technique

- Pt seated
- Proper size cuff
  - Bladder should encircle 80% (at least)
  - Too big not a problem
- 2 measurements 30 min apart
- Mercury vs. aneroid vs. automated

Reeves. JAMA ’95

BP measurement: sources of error

Falsely Raises BP

- Cuff too small
- Rapid deflation (falsely ↑ DBP)
- Singing, talking
- Caffeine, tobacco, EtOH
- “White coat” (↑ up to 20/10)
- Pain / “reactive”

Falsely decreases BP

- Excessive bell pressure
- Rapid deflation (falsely ↓ SBP)

Reeves. JAMA ’95
HTN in the ED: natural history

- Variability
  - Reading to reading (minutes): SD = 7/5 mm Hg
  - Visit to visit (days): 5-12 / 6-8 mm Hg

- Average DBP ↓ 11.6 mm Hg
  - Regression to mean: 7.2 mm Hg
  - “attenuation of alerting response”: 4.4 mm Hg

Pitts. Annals Emerg Med ‘98