Hypertensive Emergencies

Lecture 28

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Outcomes

At the completion of this lecture, the learner will be able to:

- Define the terms hypertensive emergency, urgency, acute stage 3 episode, transient reactive hypertension, crisis, and malignant hypertension (5-2.103)
- Discuss the epidemiology, incidence, morbidity and mortality associated with hypertension.
  Discuss which patients are most at risk for hypertensive emergencies (5-2.102; 104)
- Discuss hypertension pathophysiology and complications of aggressively treating hypertensive emergencies (5-2.103)

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Outcomes, cont.

- Appreciate the risks of both uncontrolled **AND** too aggressively controlled hypertension (5-2.103)
- Correlate abnormal findings with clinical significance in patients with hypertensive emergencies (5-2.111)
- Discuss hypertensive emergency assessment findings will help determine a "CUPS"-like classification (5-2.108-109)
- Define an "acute stage 3 episode"
- Discuss antihypertensive drugs and treatments used to treat a hypertensive emergency, urgency, acute stage 3 episode, and transient reactive hypertension (5-2.110)

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Emergency Clinician Responsibility

- Recognize and treat true emergencies
- Avoid causing harm (primum non nocere)
- Encourage appropriate follow-up of all non-emergency cases

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Etiology

- Essential hypertension (idiopathic)
  - Most cases are "essential" (90%)
  - No other obvious cause on routine evaluation
- Renal
- Congenital
  - Renal artery stenosis
  - Coarctation of the aorta
- Endocrine
  - Pheochromocytoma
  - Hyperaldosteronism

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Epidemiology

- CV disease risk factors
  – one of most important modifiable
- 4th most prevalent chronic medical condition in U.S.
- Prevalence: 25% of the adult population, in general
- Present in 33 % of adult African-American population
- 33% of patients unaware of their diagnosis
- Only 50% make the necessary lifestyle and/or prescription medication changes to adequately control blood pressure below 140 / 90 .
  Even fewer will maintain a BP less than 115/75

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Normal BP Physiology

Systemic blood pressure is related to vascular smooth muscle tone :

- α_1 and α_2 receptors
  - → Norepinephrine
    - → release of intracellular calcium
      - → smooth muscle contraction (actin and myosin)
        - → Increase in PVR

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Hypertensive Disease

- Any BP greater than ***115/75*** mm Hg → some increase CV risk
- But process ***not*** defined by a specific BP value
- Failure of autoregulation
  - Not just in the brain [as in head trauma], but
  - Locally in the arteriolar bed
  - Dysregulation of the renin-angiotensin system (RAS)
    - Treating this dysregulation of the RAS protects: heart, brain, and kidney (HBO)
- Alterations in arterial muscle wall

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Pathophysiology of Hypertension

- Failure of autoregulation
  - Not just in the brain [as in head trauma], but in all arterioles (coronary, retinal, renal)
  - Dysregulation of the renin-angiotensin system (RAS)
    - Treating this dysregulation of the RAS protects: heart, brain, and kidney (HBO)
  - Consequences:
    - dysregulation of intra-arterial pressure
    - Injury to the endothelium
      - vascular wall injury
      - progressive scarring and narrowing
- Alterations in arterial muscle wall
  - Hypertension changes in CADs → decrease in coronary flow
    - Angina ; MI

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Definition of a Hypertensive Emergency

Hypertensive emergencies are *NOT* diagnosed on the basis of one isolated BP reading

Hypertensive Emergency

- an emergency that requires immediate treatment (within the hour) is defined as ***BOTH*** :

1). Elevated BP [Stage 4 hypertension (DBP > 120-130)] , ***AND***

2). ongoing organ (heart, brain,…) injury.

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Classification - Old Terms

- Hypertensive emergency
- Hypertensive urgency
- Acute non emergent, non urgent hypertensive episode
  - also called: acute stage three hypertension
- Transient, reactive hypertensive episode
- Malignant hypertension :
  - old term for syndrome of acutely accelerating BP

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New Classification

Newer terms and approach

1. Hypertensive emergency or hypertensive crisis :
   - Defined as severely elevated BP associated with acute end organ (or target organ) damage
   - Malignant hypertension (cerebral edema)
2. Everything else:
   - Severe hypertension ***without*** evidence of acute target organ injury
     - Requires BP reduction over days not hours

Classification

- Determines treatment plan

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Prioritization: Emergent

Hypertensive emergencies
- Ongoing target organ damage
- Terms used to refer to a hypertensive emergency
  - malignant hypertension
  - hypertensive crisis
- Treatment goal: reduce blood pressure in ***one hour***
- Types of Organ Injury in Hypertensive Emergencies: HBO TV
  - Heart (pulmonary edema)
  - Brain (encephalopathy)
  - Other organs
    - eye (acute retinal hemorrhage)
    - Kidney (acute renal failure)
  - Toxemia or severe pre eclampsia, and
  - Vessels (aneurysm or dissection : thoracic and abdominal)

Hypertensive Emergency or Crisis

Malignant hypertension :
- Old term for syndrome of acutely accelerating BP elevation
- May be fatal if not promptly treated
  - Marked increase in PVR
    - Systemic angiotensin II +/or
    - Endothelin localized vasoconstriction
- Diastolic BP > 130 mm Hg
- Cerebral edema
  - papilledema
  - encephalopathy
- Heart failure often accompanies encephalopathy

Old "Hypertensive Urgency"

- Immanent risk of target organ damage
- No ongoing target organ damage
- Risk of target organ damage
- DBP > 115 mmHg
- *Old* treatment goal: reduce blood pressure in *one day*
- ***New*** treatment goal: reduce blood pressure in 3 weeks to ***one month***

"High Blood Pressure"

Joint National Committee on High Blood Pressure recommendations for appropriate follow-up, assuming ***no*** target organ damage :
- Prehypertension (SBP 120-139, DBP 80-89):
  - BP should be rechecked within ***1 year***.
- Stage I HTN (SBP 140-159, DBP 90-99):
  - BP should be rechecked within ***2 months***.
- Stage II HTN: (SBP > 160 or DBP >100):
  - Refer to primary care within ***1 month***.
- If BP is >180/ 110 ,
  - Patient should be evaluated and treated in ***1 day - 1 week.***

Acute Stage 3 Hypertension

Acute
Non Emergent, Hypertensive Episode
- Also called: acute stage **3** hypertension
  - SBP > 180 ; DBP > 110 mmHg
- ***NO*** signs of impending target-organ damage
- Treatment goals
  - ***Avoid rapid reduction***
  - No evidence that acute reduction is beneficial
  - Follow-up in one day-one week
  - Reduce blood pressure in **3** weeks - one month

Transient, Reactive Hypertensive Episode

- Transient increase in catecholamines
  - "White coat hypertension "
  - Drug-related
    - Alcohol, cocaine, caffeine
    - Alcohol withdrawal
- Patients become normotensive
  - As soon as catecholamine levels subside
  - And once they are in their normal environment
- 20% of newly labeled " hypertensives " aren't
  - Cannot Dx new onset hypertension in single encounter

Treatment Guidelines

Chronic

- For every 2 mm Hg of BP reduction, the benefit is approx.:
  - 7% reduction in coronary heart disease
  - 10% reduction in stroke.

Acute

- Aggressively treating an elevated BP may be dangerous
- Inappropriately, aggressively, or precipitously lowering the blood pressure may:
  - Cause myocardial infarction
  - Worsen a CVA
  - Worsen aortic dissection

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Prehospital Treatment of Hypertensive Emergencies

- Indication : end organ injury - primarily :
  - cardiac (and occasionally brain)
  - pregnancy hypertensive emergencies
- Agents commonly available for prehospital treatment
  - NTG (SL & paste)
  - labetalol
  - lasix
  - magnesium

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Prehospital Treatment of Hypertensive Emergencies

- Other agents less commonly used in prehospital treatment
  - Nitroprusside
  - Hydralazine
  - Ca^{++} blockers
  - ACE Inhibitors
  - Clonidine (Catapres®)
- New agents
  - Nicardipine
  - Fenoldopam
  - Aliskiren

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Anti - Hypertensives : NTG

Mechanism of action:

- smooth muscle dilator (arteriolar and veno dilation)
- cardiac output unchanged

Dose:

- chest pain: SL 0.4 mg /tab Q five min.
- pulmo. edema: SL 0.4-1.2 mg /tab Q five min.
  paste: 2 in.
  IV: start 5 mic/min and incr by 5 Q 5
  5-200 mic./min

Onset : 5 min.

Duration : 5 min.

Adverse effects:

- headache

Contra indications

- Prior use of PDE-5-inhibitors (sildenafil, tadalafil, or vardenafil)
- RV MI

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Beta Blockers

Labetolol

- Mechanism of action (both alpha and beta)
  - α_1 blocker
    - smooth muscle dilator
  - β blocker
    - ***no reflex tachycardia***
      - cardiac output unchanged
- Dose : IV 20 mg Q 10 minutes
- Onset: 5 min.
- Duration : 6 hr.
- Adverse effects
  - bronchospasm
  - CHF exacerbation
  - heart block
  - low doses may lead to paradoxical hypertension (unopposed α)

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Contraindications to Beta Blocker Therapy

Absolute +/-

- Severe LV CHF [Pulmonary Edema]
- HR < 60
- BP < 100 mmHg
- poor peripheral perfusion [shock]
- 2nd or 3rd degree heart block

Relative

- COPD / asthma
- CHF

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ACE Inhibitors

Angiotensin 1 ***C***onverting ***E***nzyme Inhibitors

IV: Enalapril

- MOA:
  - Angiotensin inhibition
    - vasodilation
      - coronary
      - pulmonary
      - peripheral
- Dose : 0.625 mg IV
- Onset : 30 minutes

PO: Captopril

- Dose: 12.5 mg
- Onset: 30 minutes

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Calcium Channel Blockers

IV: Nicardipine

- MOA
  - Vasodilator
    - coronary > peripheral
- Dose: 10 mg / hr
- Contraindications: aortic stenosis
- Indications:
  - may be particularly good in SAH
- Side effects:
  - Headache
  - ***No*** negative inotropy (actually improves inotropy)

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Calcium Channel Blockers

Nifedipine - po

- Dose: 10 mg
- Onset: 10 min.
- Indications:
  - never specifically approved
    - for short acting treatment of BP
    - of any kind
- Adverse effects:
  - MI
  - angina
  - stroke

AHA:

Ca^{++} blockers "…***do not*** reduce mortality in acute MI... data suggest that they are ***harmful*** ..."

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Nitroprusside

- MOA
  - Vascular smooth muscle dilator
- Dose: 0.3 mic./ kg/min.
- Onset: seconds
- Adverse effects:
  - cyanide poisoning
  - ventilation-perfusion mismatch
  - coronary steal- myocardial ischemia
  - increased intracranial pressure

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Clonidine

- MOA
  - direct-acting central [brain] adrenergic agonist
  - ***Avoid*** in malignant hypertensive encephalopathy
- Dose: 0.1-0.2mg q1 hr po (max .0.8mg)
- Onset: 30-60 min
- Adverse effects:
  - Sedation, dry mouth, dizziness, drowsiness . Severe ***rebound***
- Newer non-hypertensive uses of clonidine
  - Narcotic detoxification and withdrawal
  - Insomnia
  - Counter stimulant medications such as Adderall and methylphenidate (Ritalin) – used for ADHD [1.]
  - Tourette syndrome [1.]

1. Treatment of ADHD in children with tics." *Neurology*, Vol. 58, No. 4, Feb 26, 2002, pp. 527-536.

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Newer Agents

Fenoldopam (Corlopam)

- 0.1-0.3 mcg / kg / min IV (max.: 1.6 mic/kg/min)
- MOA
  - peripheral Dopamine receptor stimulator (DA_1) agonist
    - resulting in vasodilation
- Precaution
  - Acetaminophen may increase levels (30-70%)
  - Beta-blockers increase hypotensive effect
    - Reflex tachycardia
      - Caution in angina

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New Agents

Aliskiren (Rasilez)

- Dose: 150; 300 mg po
- MOA
  - renin inhibitor (interrupts RA system)
    - results in vasodilation

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Hypertensive Emergency Algorithm

Hypertension: Y/ N ?

- S BP > 140
- D BP > 90

Target organ injury: Y/ N ?

- [HBO TV] [Heart, Brain, Other, Toxemia, Vessel]
  - Yes:
    - emergency parenteral agents
      - N T G, ...
  - No:
    - consider transdermal or oral agent
      - Clonidine

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Hypertension Algorithm

Target organ injury:

- Heart
  - Chest pain
    - NTG SL or IV
    - Consider Lasix 40 mg IV
    - Consider morphine
  - Pulmonary edema:
    - NTG SL or IV
    - Lasix 100 mg IV
    - consider CPAP
    - consider morphine
    - first-line therapy : NTG

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Algorithm End Point

Target organ injury: Brain

- Encephalopathy
  - Extreme BP overwhelms autoregulation
  - Cerebral edema
  - Sx.: severe HA; N, V, visual sx., ALOC: “crazy”
    - wandering focal neuro. deficits
  - Sn.: papilledema, retinal hemorrhages; CHF
  - Tx: reduce MAP [or DBP*] by ***20%***
    - [MAP = DBP + (SBP – DBP) / ***3***]
    - by ***ONLY*** 20% , over ***3***0 minutes

* ~ 5% diff., if you use DBP

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Algorithm

Target organ injuries:

- Brain : Encephalopathy:
  - IV NTG
  - IV nitroprusside
  - Beta blockers
  - Labetolol 20 mg IV

- Aorta - AAA / TA
  - Labetolol, ***first***
  - Then, combination
    - beta blocker and
    - nitroprusside

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Severe Pre Eclampsia

Definition

- S BP > 160
- DBP > 110
- Severe headache
- Visual disturbance
- Abdominal pain
- Hyper reflexia

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Severe Pre Eclampsia Tx.

- Mg^{++} **4** grams IV
- Left lateral position
- Labetolol 20 mg IV
- Hydralazine (traditional ~ OOD)

Summary

We have discussed:

- Risk factors which predispose to hypertensive injury
- Terms : hypertensive emergency, urgency, acute stage 3 episode, transient reactive hypertension, crisis, and malignant hypertension
- Hazards of both uncontrolled **AND** too aggressively controlled BP
- Correlation of abnormal findings with clinical significance in patients with each hypertensive classification, including the "acute stage 3 episode"
- Antihypertensive drugs and treatments used to treat a hypertensive emergency and urgency

Notes

- Lewington S, et al. Prospective Studies Collaboration. Age-specific relevance of usual blood pressure to vascular mortality: a meta-analysis of individual data for one million adults in 61 prospective studies. *Lancet.* 2002;360:1903-1913.
- JNC VII : Chobanian AV, Bakris GL, Black HR, et al; Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure. … *Hypertension.* 2003;42:1206-1252.
- Reduce MAP [or DBP]
  - MAP : [1/3(SBP - DBP) + DBP]
  - e.g., MAP for a pressure of 220/140 = 1/3(220 - 140) + 140 = 167
    167 x 0.20= 33; DBP of 140-33= 107
    The DBP shortcut: 140 x 0.20= 28; DBP of 140-28= 112