Essential Learning

Hypertension - Emergent Management

- **Complications of Hypertension**
    - In patients with severe hypertension, complications/end organ dysfunction suggestive of hypertensive emergency includes retinopathy, papilledema, pulmonary edema, new mitral regurgitation (papillary muscle rupture), aortic aneurysm or dissection, acute coronary syndrome, congestive heart failure, acute renal insufficiency, ischemic or hemorrhagic stroke, altered mental status due to HTN encephalopathy or PRES (posterior reversible encephalopathy syndrome).

- **How is hypertension defined?**
    - Normal BP is <120/80 mm Hg
    - Asymptomatic Hypertension
        - BP > 140/90, without apparent symptoms
    - Severe Asymptomatic Hypertension (previously Hypertensive Urgency)
        - Severe BP elevation (>180/120) without signs of end organ dysfunction
    - Hypertensive Emergency
        - Severe BP elevation (>180/120) with evidence of end organ dysfunction including:
            - Encephalopathy, ischemic or hemorrhagic strokes, SAH
            - Aortic dissection, MI, CHF
            - Pulmonary edema
            - Renal insufficiency
            - Retinopathy
    - Note that the rate of BP elevation relative to baseline, not the number itself, most significantly impacts the likelihood of end organ dysfunction.

- **What are the physical findings associated with long-standing hypertension?**
    - Ocular exam -- hypertensive retinopathy, “A-V” nicking, papilledema
    - Cardiac exam -- S3, possible JVD, abnormal ECG
    - Pulmonary exam -- crackles
    - Renal -- elevated creatinine
    - Neurologic -- altered mental status, headache, or visual findings

- **What ECG findings are seen with long standing hypertension?**
    - Left ventricular hypertrophy often manifests on ECG, although this is not a sensitive finding (echo is gold standard for diagnosis)

- LVH is seen on ECG as increased R wave amplitude in left-facing leads I, aVL, V4-6 as well as increased S wave depth in right-facing leads III, aVR, V1-3.
  - Various voltage criteria exist, most commonly used is S wave in V1 = R wave in V5 or V6 > 35 mm
- Voltage criteria + any non voltage criteria (below) = LVH
  - Increased R wave peak time > 50 ms in leads V5 or V6, causes widened QRS
  - LV strain pattern: ST segment depression and T wave inversion in I, aVL, and V4-6 (left-sided leads, result from prolonged depolarization and the repolarization time)
- Other ECG changes may include
  - Left axis deviation
  - Left atrial enlargement (broad, bifid P waves)
  - ST elevation in the right precordial leads V1-3 (“discordant” to the deep S waves)
  - Prominent U waves
  - Severe LVH looks similar to left bundle branch block
- LVH with strain can look similar to acute ischemia
  - If the patient is not meeting criteria for LVH and has new STE or STD, assume acute ischemia
  - Other distinguishing features include T wave asymmetry and V6 TWI >3mm, both more likely in LVH

- **How is hypertension managed in the ED?**
  - Patients with HTN who do NOT have signs or symptoms of acute end organ dysfunction do NOT require extensive workup or treatment in the ED; doing so may actually cause harm (complications of antihypertensives, stroke 2/2 rapid lowering of BP, etc)
  - Patients are often volume depleted due to pressure natriuresis and may require IV fluid bolus in addition to IV antihypertensives; care should be taken not to cause iatrogenic hypotension which could lead to progressive ischemia and poor outcomes.
  - Asymptomatic Hypertension
    - Restart home meds prn
    - DC with outpatient follow-up for med selection/titration (significant variation in practice here)
  - Severe Hypertension
    - Rule out end organ dysfunction per labs or based on signs and symptoms
    - Consider restarting home medications and/or initiation of new medications
    - Close outpatient follow up
  - Hypertensive Emergency
    - In general, goal 25% MAP reduction over 1-2 hr, to 160/100 over 6-12hr, and to normal range over 24-48hr. Some sources recommend a more gradual lowering by 10-20% in the first hour and a total of 25% within 24hr. There are some exceptions to these goals, as noted below.
    - Medication options, preference by complication type (below)
      - Nicardipine gtt: 2.5-5 mg/h IV titrate to effect (max 15 mg/h)

- Labetalol bolus and gtt: 10-40 mg IV bolus, then 2-8 mg/min
- Nitroglycerin +/- SL and gtt: 0.4 mg q5min x3 sublingual, 5-400 µg/min IV (significant variation, consider starting around 200 and titrating)
- Esmolol gtt: 500 µg/kg bolus over 1 min followed by 50 µg/kg/min continuous infusion; may titrate up by 25-50 µg/kg/min every 5-15 min to a max of 300 µg/kg/min
- Metoprolol IV/PO: 5 mg IV bolus or 25-50 mg PO (mild cases)
- Nitroprusside gtt: 0.3 µg/kg/min IV titrate to effect by 0.5 µg/kg/min q5 min

■ Specific Treatment and Goals by Complication:
■ Neurologic symptoms with hypertension: IV Nicardipine or IV Labetalol
- Ischemic Stroke: permissive HTN (<220/120) or <185/110 mmHg if tPA is given
- Hemorrhagic Stroke: +/- permissive HTN, SBP 140-180 mm Hg
- HTN Encephalopathy and PRES: reduce MAP by 15% in the first hour and 25% in the first 24 hours

■ Aortic Dissection: IV Esmolol +/- IV Nitroprusside or IV nicardipine
- Note lower HR (60) and BP (100-120 mmHg) goals than typical HTN emergency

■ MI: IV Nitroglycerin (SL or gtt) +/- Beta-blocker (Metoprolol or Labetalol)
■ Pulmonary Edema: IV Nitroglycerin (SL, gtt), IV Lasix
■ Renal Insufficiency: Nicardipine, Fenoldopam or Clevidipine
■ These patients benefit from arterial line placement and require ICU admission for close monitoring.

- **When are additional imaging modalities or procedures indicated in the ED?**
  - If the patient's presentation is concerning for subarachnoid hemorrhage:
    - In a neuro-intact patient with a negative CT brain within 6 hours of onset of headache there is a < 1% chance of aneurysmal SAH.
    - If more than 6 hours have passed, the sensitivity to detect blood on a CT brain declines, and an LP should be considered to rule out SAH.
    - Clinical practices and sensitivity of CT for SAH are evolving
  - CTA of the head and neck can be considered, if there is clinical concern for cervical artery dissection, or as part of a stroke workup.
  - MRI may be needed to identify ischemic strokes or changes caused by posterior reversible encephalopathy syndrome (PRES).
  - An arterial line is generally indicated in patients with HTN emergency.

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- **References:**

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