Vital signs show BP elevation >140/90mmHg

Reassess BP with patient in resting position (sitting or supine) not moving or talking. This should ideally be performed 60-80 minutes after the initial elevated triage BP.16

(See Supplement 1, page 4)

BP now <140/90mmHg?

Yes

- Discharge to home; with outpatient follow up for reassessment within 2 months7, 11, 13, 26, 34
  - Counsel on lifestyle modifications to prevent and manage hypertension (See Table 1, page 5)

No

BP >180/110mmHg Or >140/90mmHg and suspected acute end organ damage based on symptoms or presentation?

Yes

- Discharge to home; with outpatient follow up for reassessment in 1 week to 1 month7, 11, 26, 34
  (See Box 1)

No

Assess for end organ damage based on History and Physical Exam. Consider the following depending on presentation and symptoms:
- CBC
- Renal Panel
- Troponin
- BNP
- UA
- BNP
- CXR
- Head CT

Evidence of acute end organ damage?

Yes

Treat for Hypertensive Urgency7, 13, 26, 34
(See Box 2)

No

Go to pathway for Hypertensive Emergency (pg. 2)
- Requires continuous monitoring
- Initiation of IV anti-hypertensive therapy
- Admission to hospital to at least stepdown status

Box 1

If NO prior documentation or history of hypertension:
- Inform patient of elevated BP
- Note BP in dictation
- Write BP on discharge paperwork
- Refer to primary care physician using existing mechanisms
- Counsel on lifestyle modifications to prevent and manage hypertension (See Table 1, page 5)
- Give patient the discharge instructions for high blood pressure (page 10)
- Consider initiation of monotherapy. Recommend thiazide diuretic or alternative for compelling indication.13 (See Table 2 for dosage)
- Consider obtaining baseline renal panel for assessment of potassium and renal function prior to initiation of therapy13

If known history of hypertension:
- If noncompliant consider reinitiating therapy13, 34
- If compliant and on monotherapy, consider escalation to dual therapy (Recommend thiazide diuretic plus Ace Inhibitor or Calcium Channel Blocker)11, 34 (See Table 2 for dosage)
- Consider renal panel to assess renal function and potassium level if reinitiating or starting new therapy3
- Refer to primary care physician using existing mechanisms
- Counsel on lifestyle modifications to prevent and manage hypertension (See Table 1, page 5)
- Give patient the discharge instructions for high blood pressure (page 10)

▲ DO NOT attempt to normalize BP in the ED; not necessary and may be detrimental11, 13, 34

Box 2

Hypertensive Urgency

If NO prior documentation or history of hypertension:
- Consider initiation of 2 drug oral therapy especially if BP>200/120mmHg (Recommend thiazide diuretic plus Ace Inhibitor or Calcium Channel Blocker)11, 34 (See Table 2 for dosage)
- Consider obtaining baseline renal panel (if not already performed) for assessment of potassium and renal function prior to initiation of therapy3
- Consider admission to observation protocol depending on social situation, access to medical care and time of presentation to ED7
- If discharging to home, inform patient and note BP in dictation and on discharge paperwork
- Refer to primary care physician using existing mechanisms with follow up as soon as possible; ideally within 1 week
- Counsel on lifestyle modifications to prevent and manage hypertension (See Table 1, Page 5)
- Give patient the discharge instructions for high blood pressure (page 10)

If known history of hypertension:
- If noncompliant consider reinitiating therapy13, 34
- If compliant, ensure on dual therapy13, 34 (See Table 2 for dosage)
- Consider observation in ED for 3-6 hours depending on patient’s social situation and access to care7
- Refer to primary care physician using existing mechanisms with follow up as soon as possible; ideally within 1 week
- Counsel on lifestyle modifications to prevent and manage hypertension (See Table 1, page 5)
- Give patient the discharge instructions for high blood pressure (page 10)

▲ DO NOT attempt to normalize BP in the ED; not necessary and may be detrimental11, 13, 34
BP elevated (usually >180/120mmHg) with objective evidence of acute end organ damage

Refer to the individual diagnoses below. All diagnoses below require admission to the hospital to at least step down status.

- **Acute Ischemic Stroke?**
  - Yes
    - Yes (IPA candidate or Post IPA admin?)
    - Yes
      - For SBP >180mmHg, recommend reduction to a goal of 160/90mmHg.
        - Acute lowering to SBP 140mmHg is probably safe.
        - Discuss with your Neurointensivist or other Critical Care Consultant.
        - Recommend IV Nicardipine or Labetalol (See Table 3 for dosage).
    - No
      - No
        - No
          - No

- **Acute Intracerebral Hemorrhage?**
  - Yes
    - Yes
      - Goal reduction to SBP <160/110mmHg.
        - Discuss with your Neurointensivist or other Critical Care Consultant.
        - Recommend IV Nicardipine or Labetalol (See Table 3 for dosage).
    - No
      - No
        - Acute hypotensive encephalopathy?
          - Yes
            - Yes
              - Yes (STEMI & considering fibrinolitics?)
                - Yes
                  - Goal: BP <185/110mmHg.
                    - Recommend IV or SL Nitroglycerin with IV Labetalol or Esmolol (See Table 3 for dosage).
                - No (NSTEMI or unstable angina with sx of HTN & BP>160/110mmHg?)
                  - Yes
                    - Goal: MAP reduction by 20-30% of starting MAP.
                      - Recommend IV or SL Nitroglycerin and IV Metoprolol (See Table 3 for dosage).
                  - No
                    - No emergent intervention required.
                      - Discuss with Cardiology.
            - No
              - No
                - Acute Coronary Syndrome?
                  - Yes
                    - STEMI & considering fibrinolitics?
                      - Yes
                        - Goal: BP <185/110mmHg.
                          - Recommend IV or SL Nitroglycerin with IV Labetalol or Esmolol (See Table 3 for dosage).
                      - No
                        - No (NSTEMI or unstable angina with sx of HTN & BP>160/110mmHg?)
                          - Yes
                            - Goal: MAP reduction by 20-30% of starting MAP.
                              - Recommend IV or SL Nitroglycerin and IV Metoprolol (See Table 3 for dosage).
                          - No
                            - Continue on Page 3

Contraindications to Beta-Blockers

It is reasonable to administer IV beta blockers as indicated to patients with hypertension who do NOT have 1 or more of the following:

1. Signs of Heart Failure
2. Evidence of a low-output state
3. Increase risk for cardiogenic shock, or
4. Other relative contraindication to beta blockade (PR interval greater than 0.24s, second or third degree heart block, active asthma or reactive airway disease).

*as defined by elevated troponins or ECG changes
Acute Decompensated Heart Failure?
- Goal reduction: SBP by 30mmHg. Caution: SBP lowered to <120mmHg acutely has been associated with adverse outcomes.15, 31
- Recommend IV and SL Nitroglycerin or Nitroprusside.15 (See Table 3 for dosage)
- Consider IV ACEI as needed
- Non-invasive ventilation may also lower BP

Acute Aortic dissection?
- Goal: SBP<120-110mmHg & HR 60 within 20 minutes of diagnosis
- Recommend IV Nicardipine or Nitroprusside + Esmolol or Labetolol +Morphine11, 12, 13, 17, 26 (See Table 3 for dosage)
▲ Avoid Beta Blockers in presence of valve regurgitation or cardiac tamponade3

Renal Insufficiency or Failure?*
- Goal: Reduction in SBP by 20%
- Discuss with renal consultant
- Recommend Nicardipine, Clevidipine or Fenoldopam4, 7 (See Table 3 for dosage)

Preeclampsia/ Eclampsia?
- Goal SBP: 130-150mmHg
- Goal DBP: 80-100mmHg
- Recommend IV Hydralazine or Labetalol (See Table 3 for dosage)
- Avoid Nitroprusside, ACEI and Esmolol
- Discuss with Obstetrics Consultant
- For seizures/eclampsia: Magnesium 6g IV over 15-20 minutes followed by 2g/hr infusion1, 6

*As defined by an acute decrease in eGFR of >25% from baseline.22 (If no known baseline, one must assume any insufficiency is acute organ damage.)

Contraindications to Beta-Blockers
- It is reasonable to administer IV beta blockers as indicated to patients with hypertension who do NOT have 1 or more of the following:
  1. Signs of Heart Failure
  2. Evidence of a low-output state
  3. Increase risk for cardiogenic shock, or
  4. Other relative contraindication to beta blockade (PR interval greater than 0.24s, second or third degree heart block, active asthma or reactive airway disease).
SUPPLEMENT 1: Helpful Tips for Obtaining An Accurate Blood Pressure

1) Ideally, blood pressure should be taken at least 30 minutes after smoking or drinking caffeinated beverages.

2) Ensure the room is as quiet and comfortable as possible.

3) Ask the patient to sit or lay quietly for at least 5 minutes prior to measurement.

4) Make sure the arm selected is free of clothing. Blood pressure should not be measured on an arm that has an arteriovenous fistula for dialysis, scarring from prior brachial artery cutdowns, or signs of lymphedema.

5) Position the arm so that the brachial artery, at the antecubital crease, is at the level of the heart. Rest the arm on a table or try to support the patient’s arm at the midchest level.
   **If the brachial artery is much below heart level, blood pressure appears falsely high. The patients own effort to support the arm may also raise the blood pressure.**

6) Select the correct sized blood pressure cuff.
   a. Width of the inflatable bladder of the cuff should be about 40% of the upper arm circumference (about 12-14cm in the average adult).
   b. Length of the inflatable bladder should be about 80% of the upper arm circumference (almost long enough to encircle the arm.)
   **Cuffs that are too short or too narrow may give falsely high readings.**

7) Center the inflatable bladder over the brachial artery. The lower border of the cuff should be about 2.5cm above the antecubital crease. Secure the cuff snugly.
   **A loose cuff or a bladder that balloons outside the cuff leads to falsely high readings.**

<table>
<thead>
<tr>
<th>Modification</th>
<th>Recommendation</th>
<th>Approximate SBP reduction (range)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight Reduction</td>
<td>Maintain normal body weight (body mass index 18.5-24.9kg/m²)</td>
<td>5-20mmHg/10kg</td>
</tr>
<tr>
<td>Adopt DASH eating plan</td>
<td>Consume a diet rich in fruits, vegetables, and low-fat dairy products with a reduced content of saturated and total fat.</td>
<td>8-14mmHg</td>
</tr>
<tr>
<td>Dietary sodium reduction</td>
<td>Reduce dietary sodium intake to no more than 100mmol per day (2.4g sodium or 6g sodium chloride.)</td>
<td>2-8mmHg</td>
</tr>
<tr>
<td>Physical Activity</td>
<td>Engage in regular aerobic physical activity such as brisk walking (at least 30 minutes per day, most days of the week.)</td>
<td>4-9mmHg</td>
</tr>
<tr>
<td>Moderation of alcohol consumption</td>
<td>Limit consumption to no more than 2 drinks (eg. 24oz beer, 10oz wine, or 3oz 80-proof whiskey) per day in most men and no more than 1 drink per day in women and lighter weight persons</td>
<td>2-4mmHg</td>
</tr>
</tbody>
</table>

DASH indicates Dietary Approaches to Stop Hypertension
For overall cardiovascular risk reduction Stop Smoking
*The effects of implementing these modifications are dose- and time-dependent and could be greater in some individuals.

<table>
<thead>
<tr>
<th>Agent</th>
<th>Starting Dose</th>
<th>Maximum Useful Dosage</th>
<th>Indication</th>
<th>Contraindication</th>
<th>Monitoring</th>
<th>Properties/Complications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thiazide diuretics (eg, hydrochlorothiazide)</td>
<td>12.5 mg daily</td>
<td>25 mg daily</td>
<td>Drug of choice for uncomplicated hypertension; works well with other agents</td>
<td>Gout, hypokalemia, hypercalcemia</td>
<td>BMP</td>
<td>Loses effectiveness as GFR decreases; can cause multiple electrolyte disturbances; drug-induced SLE</td>
</tr>
<tr>
<td>ACE inhibitor (eg, losinopril, lisinopril)</td>
<td>5-10 mg daily</td>
<td>40 mg daily</td>
<td>Patients with CHF, diabetes, previous MI with low ejection fraction^7,8</td>
<td>Bilateral renal artery stenosis, hypovolemia</td>
<td>BMP</td>
<td>Interrupts renin-aldosterone cascade; hyperkalemia; cough; angioedema</td>
</tr>
<tr>
<td>Angiotensin receptor blockers (eg, losartan)</td>
<td>25-50 mg daily</td>
<td>100 mg daily</td>
<td>Similar efficacy to ACE inhibitors; used for patients who cannot tolerate these inhibitors or in addition to them^7,8</td>
<td>Bilateral renal artery stenosis, hypovolemia</td>
<td>BMP</td>
<td>Interrupts renin-angiotensin-aldosterone cascade; hyperkalemia; angioedema</td>
</tr>
<tr>
<td>β-Blockers (eg, metoprolol)</td>
<td>25-50 mg bid</td>
<td>200 mg bid</td>
<td>Patients with coronary artery disease; long-term management of CHF; rate control; hyperthyroidism^7,8</td>
<td>Not a good monotherapy for lone hypertension; heart block; bradycardia; sick sinus syndrome; bronchoaspet; acute decompensated CHF exacerbation</td>
<td>ECG</td>
<td>Blocks catecholamines; can lead to bronchoospasm, bradycardia</td>
</tr>
<tr>
<td>Calcium channel blockers (eg, diltiazem)</td>
<td>180-240 mg daily</td>
<td>360-540 mg daily (formulation dependent)</td>
<td>Rate control or coronary artery disease in patients who cannot take β-blockers</td>
<td>Not a good monotherapy for lone hypertension; long-acting agents are safer than short-acting agents; heart block; bradycardia; acute decompensated CHF exacerbation; sick sinus syndrome^7,8</td>
<td>ECG</td>
<td>Blocks calcium channels in heart and vessels; some cause edema; some affect heart rate</td>
</tr>
<tr>
<td>α2 Agonist (eg, clonidine)</td>
<td>0.1 mg bid</td>
<td>0.3 mg tid</td>
<td>Hypertension resistant to other modalities</td>
<td>Poor adherence to medical regimen</td>
<td>Monitor for hypotension</td>
<td>Orthostatic hypotension; fatigue; withdrawal may lead to severe rebound hypertension</td>
</tr>
<tr>
<td>Hydralazine (unknown mechanism of vasodilation)</td>
<td>10 mg qid</td>
<td>100 mg bid</td>
<td>Hypertension associated with pregnancy; hypertension associated with CHF in African Americans resistant to other modalities</td>
<td>Coronary artery disease</td>
<td>NA</td>
<td>Drug-induced SLE</td>
</tr>
</tbody>
</table>

Abbreviations: ACE, angiotensin-converting enzyme; bid, 2 times per day; BMP, basic metabolic panel; CHF, congestive heart failure; ECG, electrocardiogram; GFR, glomerular filtration rate; MI, myocardial infarction; NA, not applicable; qid, 4 times per day; SLE, systemic lupus erythematosus; tid, 3 times per day.

Table 3: Various classes of agents used for the ED management of hypertensive emergency, including dosage, indications, contraindications, and precautions.

<table>
<thead>
<tr>
<th>Agents</th>
<th>Dosage</th>
<th>Indications</th>
<th>Contraindications</th>
<th>Precautions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Labetalol (Normodyne)</td>
<td>20 mg (0.25 mg/kg for an 80-kg patient) IV/P during 2 min; may administer 40-80 mg at 10-min intervals, up to 300 mg total dose. Alternatively, IV infusion: Initially, 2 mg/min; titrate to response up to 300 mg total dose, if needed.</td>
<td>α1, β1, and β2-blocker, especially useful with aortic dissection. Decreases BP, reduces incidence of myocardial infarctions and death. Documented hypersensitivity to labetalol, sinus bradycardia, heart block, cardiogenic shock, bronchial asthma, uncompensated cardiac failure</td>
<td>Caution in impaired hepatic function; in elderly patients, a lower response rate and higher incidence of toxicity may be observed; avoid concurrent IV use with diltiazem or verapamil; caution in compensated heart failure and monitor for worsening of condition; not for administration to patients with bronchospastic disease; may mask prominent hypoglycemic symptoms and signs of thyrotoxicosis</td>
<td></td>
</tr>
<tr>
<td>Esmolol (Brevibloc)</td>
<td>Loading dose: 250–500 μg/kg, infused during 1–3 min IV. Maintenance infusion: 50 μg/kg/min IV during 4 min; if adequate effect not observed within 5 min, repeat loading dose and follow with maintenance infusion, using increments of 50 μg/kg/min IV (for 4 min); this regimen may be repeated up to 4 times if necessary. As desired BP approached, skip loading infusion and reduce dose increments in maintenance infusion from 50 μg/kg/min IV to 25 μg/kg/min; if necessary, may increase interval between titration steps from 5–10 min.</td>
<td>Ideal for use in patients at risk for complications from β-blockers, especially patients with mild to moderately severe LV dysfunction or peripheral vascular disease. Has short half-life of 8 min; thus, easily titratable to desired effect. In addition, therapy may be stopped quickly if necessary. Documented hypersensitivity to esmolol or any component of formulation, sinus bradycardia, heart block, cardiogenic shock, bronchial asthma (relative), uncompensated cardiac failure, hypotension, pregnancy (second and third trimesters)</td>
<td>Hypotension is common; patients need close BP monitoring; administer cautiously in compensated heart failure and monitor for a worsening of the condition; use caution in patients with PVD (can aggravate arterial insufficiency); use caution with concurrent use of β-blockers and either verapamil or diltiazem; bradycardia or heart block can occur; avoid concurrent IV use of both agents; use β-blockers cautiously in patients with bronchospastic disease. β-Blockers can mask prominent hypoglycemic symptoms and mask signs of thyrotoxicosis; use caution in patients with renal dysfunction (active metabolite retained); do not use in treatment of hypertension associated with vasoconstriction related to hypothermia; extravasation can lead to skin necrosis and sloughing PRINT</td>
<td></td>
</tr>
<tr>
<td>Agents</td>
<td>Dosage</td>
<td>Indications</td>
<td>Contraindications</td>
<td>Precautions →</td>
</tr>
<tr>
<td>------------------------</td>
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<td>---------------</td>
</tr>
<tr>
<td>Phenolamine (Regitine)</td>
<td>Load 5–20 mg IV q5 min or intuse 0.2–0.5 mg/min</td>
<td>α1- and α2-adrenergic blocking agent, effective for pheochromocytoma and hypertension.</td>
<td>Documented hypersensitivity to phenolamine; renal impairment; coronary or cerebral arteriosclerosis; concurrent use with phosphodiesterase-5 (PDE-5) inhibitors including sildenafil (&gt;25 mg), tadalafil, or vardenafil</td>
<td>Myocardial infarction, cerebrovascular spasm, and cerebrovascular occlusion have occurred after administration; caution in patients with gait atis or peptic ulcer, tachycardia, or history of cardiac arrhythmias; may use sildenafil with extreme caution</td>
</tr>
<tr>
<td>Nitroglycerin (Nitro-Bid)</td>
<td>Continuous infusion: Start 5 μg/min, increase by 5 μg/min q3-5 min to 20 μg/min; if no response at 20 μg/min increase by 10 μg/min q3-5 min, up to 200 μg/min</td>
<td>Decreases coronary vasospasm, which increases coronary blood flow. Also induces vessel dilatation, decreasing cardiac workload.</td>
<td>Documented hypersensitivity to organic nitrates, isosorbide, nitroglycerin; concurrent use with PDE-5 inhibitors (sildenafil, tadalafil, or vardenafil); angle-closure glaucoma (intraocular pressure may be increased); head trauma or cerebral hemorrhage (increase intracranial pressure); severe anemia</td>
<td>Severe hypotension can occur; caution in volume depletion, hypotension, and right ventricular infarctions; paroxysmal bradycardia and increased angina pectoris can accompany hypotension (orthostatic hypotension can also occur and ethanol can accentuate this); tolerance develops to nitrates, and appropriate dosing is needed to minimize this (drug-free interval)</td>
</tr>
<tr>
<td>Sodium nitroprusside (Nitropress)</td>
<td>0.3–0.5 μg/kg/min IV Initial infusion, increase in increments of 0.5 μg/kg min; titrate to desired effect; Average dose: 1–6 μg/kg min; rates &gt;10 μg/kg/min may lead to cyanide toxicity</td>
<td>Reduces peripheral resistance by acting directly on arterolar and venous smooth muscle.</td>
<td>Documented hypersensitivitiy to nitroprusside; treatment of compensatory hypertension (sodium coarotation, arteriovenous shunting); high output failure; congenital optic atrophy or tobacco amblyopia</td>
<td>Except when used briefly or at low (&lt;2 μg/kg/min) infusion rates, nitroprusside gives rise to large cyanide quantities; do not use maximum dose for &gt;10 min; use extreme caution in patients with increased intracranial pressure and patients with hepatic or renal dysfunction (watch for cyanide toxicity in patients with impaired hepatic function); use lowest end of dosage range with renal impairment; thiocyanate toxicity occurs in patients with prolonged Infusions (continuous BP monitoring needed) PRINT</td>
</tr>
</tbody>
</table>
Table 3: Continued

<table>
<thead>
<tr>
<th>Agents</th>
<th>Dosage</th>
<th>Indications</th>
<th>Contraindications</th>
<th>Precautions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nicardipine (Cardene) Calcium channel blocker</td>
<td>Initiated at a rate of 5 mg/h. If target blood pressure not achieved after 15 min, increase dose by 2.5 mg/h. The 2.5 mg/h increments will continue every 15 min until the maximum dose of 15 mg/h is reached. Once the target blood pressure is reached, infusion decreased to 3 mg/h and subsequently adjusted by 1 to 2.5 mg/h to maintain target blood pressure.</td>
<td>Short-acting calcium channel blocker, indicated for short-term control of hypertension.</td>
<td>Contraindicated in patients with known hypersensitivity to the drug and those with advanced aortic stenosis. Caution is advised when administering to patients with impaired renal or hepatic function, in combination with a β-blocker in patients with CHF, and in patients with significant left ventricular dysfunction or portal hypertension.</td>
<td>Close monitoring of the blood pressure is required during therapy. Most common adverse effects are headache, hypotension, nausea/vomiting, and tachycardia. Less frequent adverse effects. In each case occurring at 1.4%. Include ECG abnormalities, postural hypotension, ventricular extrasystoles, injection-site reaction, dizziness, sweating, and polyuria.</td>
</tr>
</tbody>
</table>

Discharge Instructions:

**High Blood Pressure**

- While in the emergency department today you were found to have an elevated blood pressure.
- High blood pressure is a condition that puts you at risk for heart attack, stroke, and kidney disease. It does not usually cause symptoms. But it can be serious.

- Sometimes a person’s blood pressure gets much higher than normal causing a “high blood pressure emergency” that can even be life-threatening.
- Very high blood pressure can cause problems with your eyes, brain, kidneys and heart.
- Symptoms you may experience during a “high blood pressure emergency” are blurry vision, severe headache, nausea, vomiting, confusion, trouble breathing, chest pain, passing out, and brown or bloody urine.

1. Your blood pressure in the emergency department today was ________

2. You will need to follow up with your primary care physician as soon as possible.

3. If you do not already have a primary care physician, it is very important that you follow the instructions of your doctor today to receive follow up as soon as possible.

4. Your doctor today may want you to start taking a medication to help control your blood pressure. It is very important that you take the medication exactly as instructed.

5. To help lower your blood pressure you can also lose weight, do something active for at least 30 minutes a day, and eat food that is low in fat and salt but rich in fruits and vegetables.

6. Return immediately to the emergency department if you experience chest pain, shortness of breath, severe headache, weakness, difficulty with speech, changes in your vision, and or any other concerns.
CPQE: Hypertension Algorithm References.


