

Hypertensive Emergencies & urgencies in children

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- Proper management of children with elevated blood pressure (BP) requires working knowledge of pediatric BP standards and a clear understanding of when elevated BP requires emergency, urgent, or routine care .
- The 2017 the American Academy of Pediatrics (AAP) Clinical Practice Guideline for high BP in children and adolescents classified BP based on normative values in children younger than 13 years of age and on fixed thresholds for children 13 years of age and older

• The BP categories include:

1. Normal BP
2. Elevated BP
3. Stage 1 hypertension
4. Stage 2 hypertension

- Stage 1 hypertension - For children with stage 1 hypertension, more time is allowed for evaluation and initial treatment with nonpharmacologic therapy unless the patient is symptomatic or has hypertensive target-organ damage .
- Stage 2 hypertension - Children with stage 2 hypertension have the most severe degree of hypertension and may require urgent (asymptomatic or minor symptoms) or emergency (serious symptoms or evidence of target-organ damage) treatment.

2017 American Academy of Pediatrics updated definitions for pediatric blood pressure categories

| | For children aged 1 to <13 years | For children aged ≥13 years |
|--------------------|--|--|
| Normal BP | Systolic and diastolic BP <90 th percentile | Systolic BP <120 and diastolic BP <80 mmHg |
| Elevated BP | Systolic and diastolic BP ≥90 th percentile to <95 th percentile, or 120/80 mmHg to <95 th percentile (whichever is lower) | Systolic BP 120 to 129 and diastolic BP <80 mmHg |
| Stage 1 HTN | Systolic and diastolic BP ≥95 th percentile to <95 th percentile+12 mmHg, or 130/80 to 139/89 mmHg (whichever is lower) | 130/80 to 139/89 mmHg |
| Stage 2 HTN | Systolic and diastolic BP ≥95 th percentile+12 mmHg, or ≥140/90 mmHg (whichever is lower) | ≥140/90 mmHg |

Hypertensive Emergency

- A severe elevation in BP with symptoms or evidence of acute target-organ damage.
- Hypertensive emergencies in children most commonly manifest as **hypertensive encephalopathy** . severe BP elevation with cerebral edema and neurological symptoms of lethargy, coma, and/or seizures .
- This pathology is caused by **cerebrovascular endothelium breakdown** secondary to failure of cerebral autoregulation.

- Other sites for target-organ damage include: **eyes** (papilledema, retinal hemorrhages, and exudates), **heart** (heart failure), and **kidneys** (renal insufficiency) .

Hypertensive Urgency

- A severe elevation in BP **without** symptoms or evidence of acute target-organ damage describes a hypertensive urgency .
- A child with hypertensive urgency warrants an immediate evaluation. When the urgency arises from an **acute process** with a rapid change in mean arterial pressure, intervention should occur promptly, and treatment with IV antihypertensive medications is appropriate . However, in the setting of a **chronic condition** (chronic kidney disease) where BP has increased gradually over time, lowering of the BP should occur less quickly.

Causes of pediatric hypertensive emergencies and urgencies by age

| Infancy | Childhood | Adolescence |
|---------------------------------|---------------------------------|--|
| Renal vascular disease* | Renal parenchymal disease* | Renal parenchymal disease* |
| Congenital renal anomaly* | Renovascular disease* | Primary hypertension (including treated patients with non-adherence to medication) |
| Bronchopulmonary dysplasia* | Coarctation of the aorta | Increased intracranial pressure* |
| Coarctation of the aorta* | Pheochromocytoma | Renovascular disease |
| Volume overload | Increased intracranial pressure | Preeclampsia/eclampsia |
| Increased intracranial pressure | Drug induced/toxicologic | Drug induced/toxicologic |
| Renal parenchymal disease | | Pheochromocytoma |
| Renal vein thrombosis | | |
| Congenital adrenal hyperplasia | | |
| Tumor (eg, neuroblastoma) | | |

History

- Hematuria with a history of edema and diminished urine output in the absence of trauma - Suggests **glomerulonephritis** or other **parenchymal renal disease** .
- Abdominal pain, vomiting, and bloody diarrhea - Supports **hemolytic-uremic syndrome** as a likely etiology.
- History of umbilical artery or vein catheterization - In neonates and infants, predisposes to **renovascular disease** .
- receding streptococcal infection involving the skin or pharynx - Points to **poststreptococcal glomerulonephritis** .

- **Drugs** associated with hypertension in overdose include cocaine, amphetamines, anabolic steroids, phencyclidine (PCP), pseudoephedrine .
- Recent use of **serotonergic agents** or inadvertent coadministration of serotonergic medications causing serotonin syndrome .
- Weight loss, anxiety, and heat intolerance suggesting **hyperthyroidism** .
- Symptoms of catecholamine excess such as intermittent tachycardia, palpitations, pallor, headaches, and/or diaphoresis suggest **pheochromocytoma** .
- History of trauma to the flank potentially leading to a compressive **renal hematoma** .
- Known history of kidney disease

Physical Examination

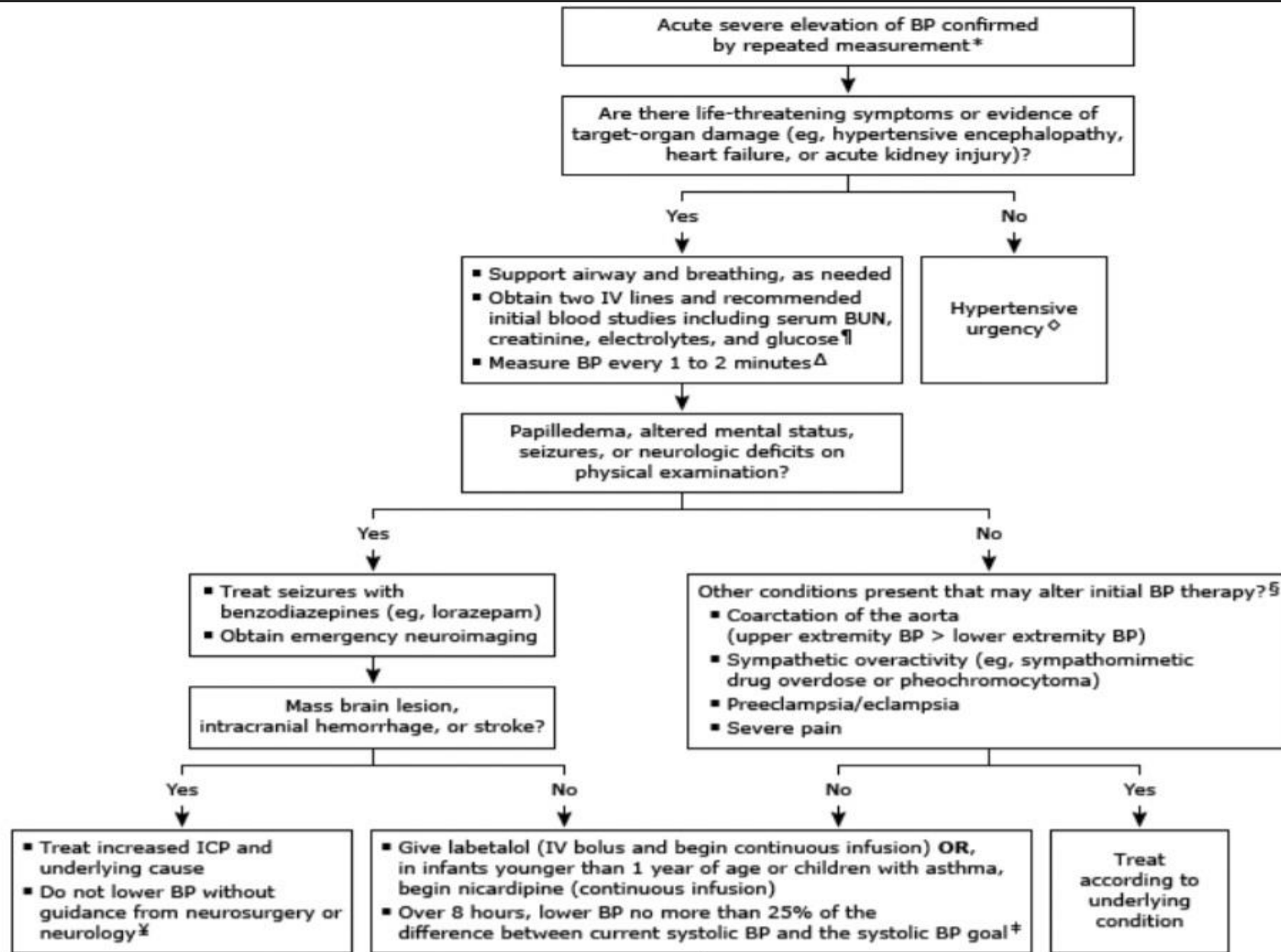
- Bruising and/or laceration of the face or scalp, palpable skull defect, or hemotympanum suggesting **head trauma with intracranial bleeding** .
- In infants, bulging fontanelle or increased head circumference suggesting **increased intracranial pressure** .
- Exophthalmos and thyromegaly associated with **hyperthyroidism** .
- Diminished femoral pulses relative to brachial pulses or disparities in four extremity blood pressures (BPs) indicating **coarctation of the aorta** .
- Abdominal mass suggesting **Wilms tumor, neuroblastoma, polycystic kidney disease, or other congenital renal anomaly**.

- Abdominal or flank bruit suggestive of **renovascular disease** .
- Bruising over the flank suggestive of **renal trauma** .
- Ataxia, papilledema, dysmetria, visual field defects, or focal neurologic deficits suggestive of **a mass brain lesion** .
- Skin findings suggesting **neurofibromatosis** (eg, cafe au lait spots, axillary freckling, cutaneous neurofibromas) or **tuberous sclerosis** (eg, Shagreen [ash leaf] patches, angiofibromas of the malar region of the face, ungual fibromas)

Ancillary Study

- Measurement of **blood urea nitrogen (BUN), serum creatinine, electrolytes, and glucose; and urinalysis with microscopy**. These tests quickly assess renal function and may indicate the presence of renal disease.
- **Complete blood count and reticulocyte count** to assess for possible anemia or thrombocytopenia often associated with hemolytic uremic syndrome and rheumatic disorders with significant renal involvement (eg, systemic lupus erythematosus)

- **Chest radiograph** and **electrocardiogram (ECG)** to screen for cardiac hypertrophy and heart failure. When indicated, **echocardiography** provides more specific information regarding left ventricular mass and function than does cardiac examination or ECG in patients with findings of heart failure .
- Patients with headache, seizures, papilledema, or focal neurologic findings warrant emergency **neuroimaging** to assess for intracranial hemorrhage, mass brain lesion, or stroke .
- **Urine toxicological screen** testing for amphetamines, PCP, and metabolites of cocaine in patients with a sympathomimetic toxidrome.



- Treat increased ICP and underlying cause
- Do not lower BP without guidance from neurosurgery or neurology[‡]

- Give labetalol (IV bolus and begin continuous infusion) **OR**, in infants younger than 1 year of age or children with asthma, begin nicardipine (continuous infusion)
- Over 8 hours, lower BP no more than 25% of the difference between current systolic BP and the systolic BP goal[‡]

Treat according to underlying condition

Signs of volume overload (heart failure or pulmonary edema)?

Yes No

Add IV diuretic (eg, furosemide or bumetanide) as needed

BP decreasing over the first 30 minutes of treatment?

Yes No

Escalate to continuous infusion of labetalol **AND** nicardipine[†]

BP decreasing over the second 30 minutes of treatment?

Yes No

- Continue careful BP lowering
- Perform further diagnostic evaluation and correct any underlying cause^{**}

Chronic kidney disease?

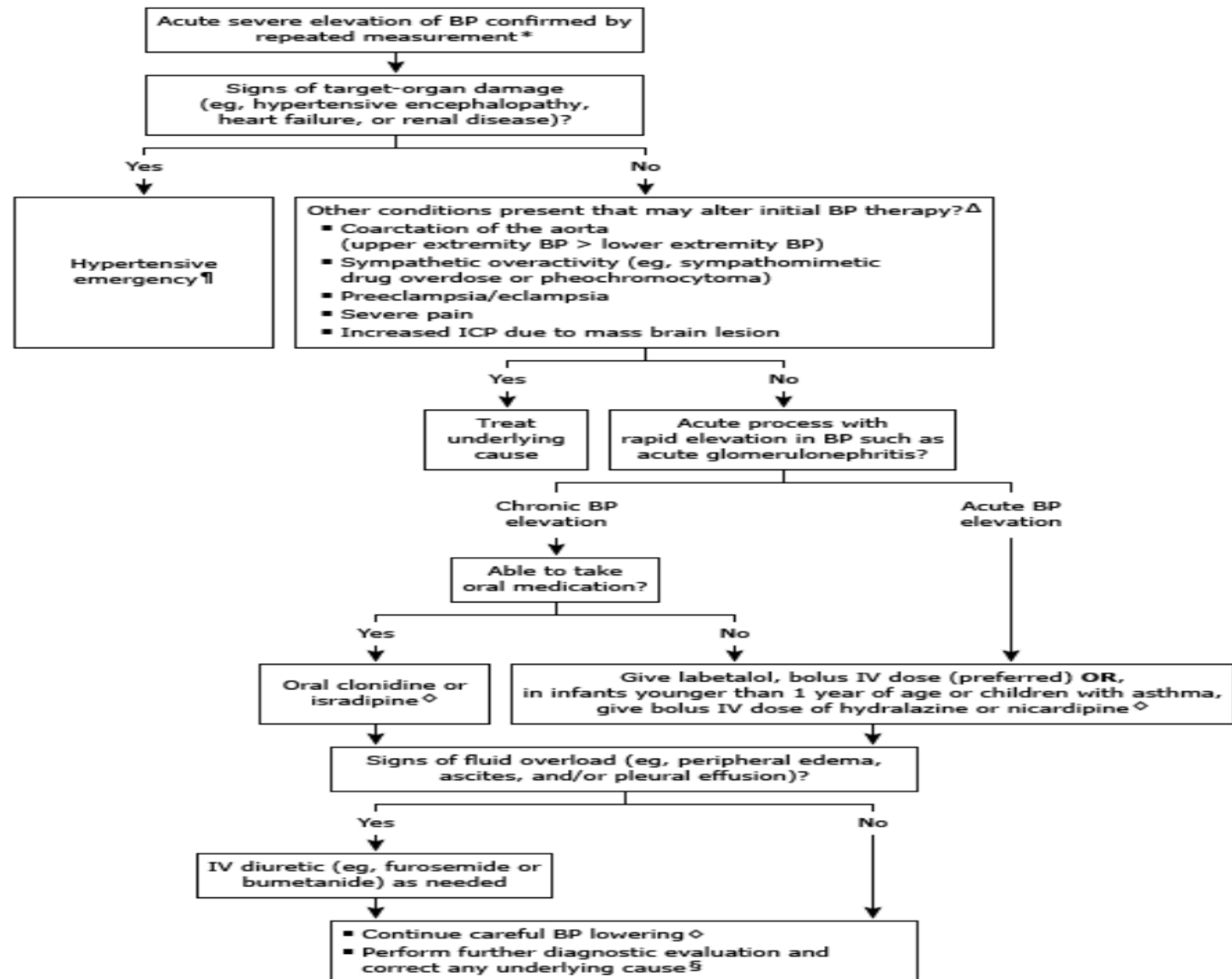
Yes No

- Add bolus IV hydralazine
- For patients with fluid overload, evaluate need for dialysis

Add continuous infusion of sodium nitroprusside

- Continue careful BP lowering
- Perform further diagnostic evaluation and correct any underlying cause^{**}

Initial management of hypertensive urgencies in children and adolescents



Thanks For your Attention