



Gestione delle crisi ipertensive in pediatria

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American Academy
of Pediatrics



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Clinical Practice Guideline for Screening and Management of High Blood Pressure in Children and Adolescents

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LINEE GUIDA IPERTENSIONE 2017

Gestione delle crisi ipertensive in pediatria

There has been an increase in the prevalence of childhood high BP, including both HTN and elevated BP

High BP is consistently greater in boys (15%–19%) than in girls (7%–12%).

The prevalence of high BP is higher among Hispanic and non-Hispanic African American children compared with non-Hispanic white children

Higher rates among adolescents than among younger children.

Therefore, the actual prevalence of clinical HTN in children and adolescents is ~3.5%.

The prevalence of persistently elevated BP (formerly termed “prehypertension,” including BP values from the 90th to 94th percentiles or between 120/80 and 130/80 mm Hg in adolescents) is also ~2.2% to 3.5%, with higher rates among children and adolescents who have overweight and obesity.

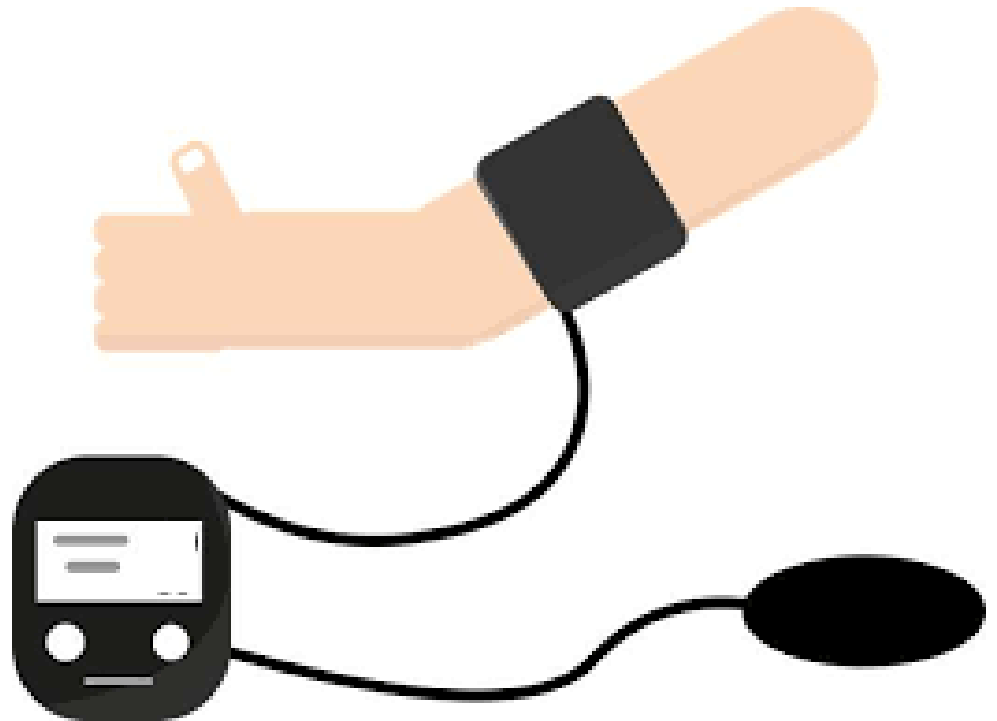
Prevalenza di IA in Europa: **2,2-13%** (in obesi fino a **22%**)

Maschi > Femmine

Prevalenza ICB: **50%** di bambini studiati con Holter-PA per PA elevata

FATTORI di RISCHIO

- **Obesità**
- **Disordini del sonno:**
russamento, frammentazione del sonno, OSAS, durata del sonno <7 ore
- **Malattie renali croniche**
- **Prematurità**
- **Basso peso alla nascita (LBW e VLBW)**





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TABLE 3 Updated Definitions of BP Categories and Stages

For Children Aged 1–13 y	For Children Aged ≥ 13 y
Normal BP: <90th percentile	Normal BP: <120/<80 mm Hg
Elevated BP: ≥ 90 th percentile to <95th percentile or 120/80 mm Hg to <95th percentile (whichever is lower)	Elevated BP: 120/<80 to 129/<80 mm Hg
Stage 1 HTN: ≥ 95 th percentile to <95th percentile + 12 mmHg, or 130/80 to 139/89 mm Hg (whichever is lower)	Stage 1 HTN: 130/80 to 139/89 mm Hg
Stage 2 HTN: ≥ 95 th percentile + 12 mm Hg, or $\geq 140/90$ mm Hg (whichever is lower)	Stage 2 HTN: $\geq 140/90$ mm Hg

Pediatric Hypertensive Emergencies

Rossana Baracco • Tej K. Mattoo

In adults, BP exceeding 180/120 mmHg fulfills criteria for hypertensive crisis. **There is no analogous discrete BP cutoff for children and adolescents.** This is not unexpected given the variability of normative absolute BP values in the pediatric population based on age, sex, and height

Based on this finding, the authors suggested that an elevation in the BP higher than the 99th percentile plus 5 mmHg may serve as a threshold for risk of hypertensive crisis in children.

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REVIEW

Evaluation and treatment of hypertensive crises in children

[Integr Blood Press Control](#). 2016; 9: 49–58.

Published online 2016 Mar 16. doi: [10.2147/IBPC.S50640](https://doi.org/10.2147/IBPC.S50640)

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Hypertensive crisis is broadly defined as a severe elevation in BP that is life threatening and has the potential to cause rapid end-organ damage.

DEFINITION

The 2017 American Academy of Pediatrics Clinical Practice Guideline on childhood hypertension suggests that clinicians become concerned about acute target-organ damage when the patient's BP exceeds 30 mmHg above the 95th percentile for sex, age, and height

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 $\geq 90^{\text{th}}$ 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 $\geq 95^{\text{th}}$ 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 $\geq 95^{\text{th}}$ percentile+12 mmHg, or $\geq 140/90$ mmHg (whichever is lower)	$\geq 140/90$ mmHg

BP: blood pressure; HTN: hypertension.

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DEFINITION

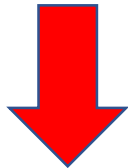
Hypertensive crises can be further categorized as hypertensive urgencies and hypertensive emergencies

Hypertensive urgency

is generally understood to be a severe, often acute, elevation in BP

without

demonstrable end-organ damage



A child with hypertensive urgency warrants a prompt evaluation. The duration of hypertension (acute or chronic) is an important determinant of intervention

Hypertensive emergency

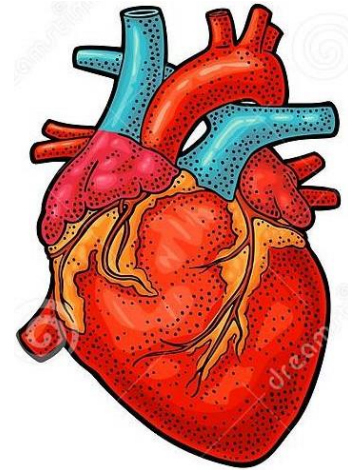
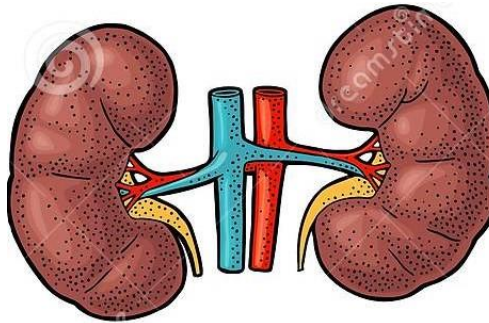
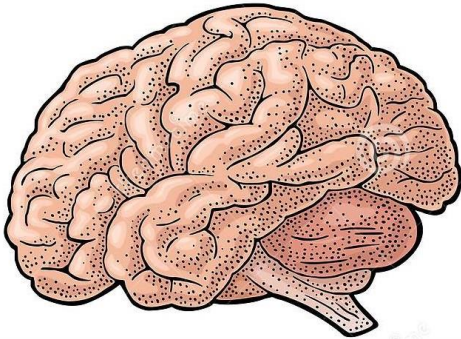
is a similar elevation in BP **with** concomitant end-organ damage.



Patients with a hypertensive emergency warrant rapid assessment to exclude conditions that might alter BP management followed by emergency administration of intravenous (IV) antihypertensive agents to rapidly lower BP

Hypertensive emergency

Most commonly, organ injury occurs in the **central nervous system, kidneys, or cardiovascular system.**



Hypertensive encephalopathy may present with the insidious onset of headache, nausea, and vomiting and can progress to severe headache, confusion, visual changes, stupor, seizure, focal neurological deficits, and coma.

Hypertensive encephalopathy is a diagnosis of exclusion, confirmed retrospectively when neurologic symptoms improve after the BP is lowered into a more normal autoregulatory range

Evaluation and management of pediatric hypertensive crises: hypertensive urgency and hypertensive emergencies

Table 1 Simple table to identify children and adolescents needing further evaluation of blood pressure

Age (years)	Males		Females	
	SBP (mmHg)	DBP (mmHg)	SBP (mmHg)	DBP (mmHg)
3	100	59	100	61
4	102	62	101	64
5	104	65	103	66
6	105	68	104	68
7	106	70	106	69
8	107	71	108	71
9	109	72	110	72
10	111	73	112	73
11	113	74	114	74
12	115	74	116	75
13	117	75	117	76
14	120	75	119	77
15	120	76	120	78
16	120	78	120	78
17	120	80	120	78
≥ 18	120	80	120	80

Notes: These values represent the lower limits for abnormal blood pressure by age and sex. Any blood pressure readings at or higher than these values represent blood pressures in the prehypertension, stage 1 hypertension, or stage 2 hypertension range and therefore should be further evaluated by a physician.

Copyright © 2009, American Academy of Pediatrics.

Adapted with permission from Kaelber DC, Pickett F. Simple table to identify children and adolescents needing further evaluation of blood pressure. *Pediatrics*. 2009;123:e972–e974.⁷

Abbreviations: DBP, diastolic blood pressure; SBP, systolic blood pressure.

Formula to estimate BP for age:

❖ Systolic = $90 + (3 \times \text{age in years})$

❖ Diastolic = $50 + (1.5 \times \text{age in years})$

ACCURATE MEASUREMENT

Regardless of the threshold used, **ACCURATE MEASUREMENT** of BP is important in identifying all children with hypertension and **is critical** for those with severe hypertension with the potential for end-organ damage.

While the gold standard for BP measurement is intra-arterial monitoring, this is not feasible in the outpatient and emergency department setting.

Oscillometric monitoring is the most common screening method, although elevated readings obtained using this modality require confirmation by manual auscultation. The BP cuff should have :

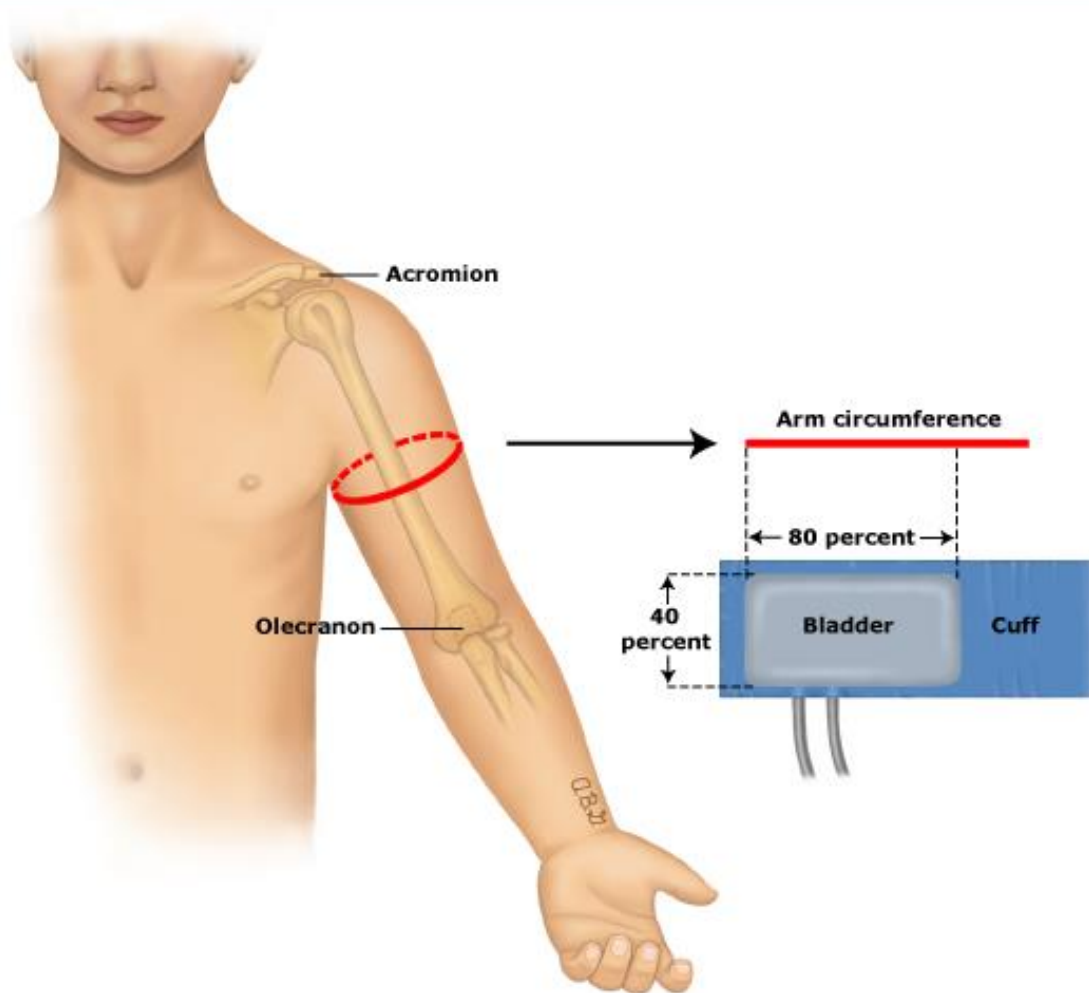
- 1) an inflatable bladder width that is a minimum of 40% of the arm circumference at the midpoint of the upper arm and
- 2) a length that is 80%–100% of the arm circumference.

Incorrect cuff size can lead to erroneous BP readings, particularly when the cuff used is inappropriately small. A high level of awareness on the part of the practitioner is also required .

The initial BP measurement may be oscillometric (on a calibrated machine that has been validated for use in the pediatric population) or auscultatory (by using a mercury or aneroid sphygmomanometer

BP should be measured in the **right arm** by using standard measurement practices unless the child has atypical aortic arch anatomy, such as right aortic arch and aortic coarctation or left aortic arch with aberrant right subclavian artery

Determining appropriate blood pressure cuff size in children



The width of the bladder of the blood pressure cuff should be approximately 40 percent of the circumference of the upper arm midway between the olecranon and the acromion. The length of the bladder of the cuff should encircle 80 to 100 percent of the circumference of the upper arm at the same position.

The bladder width-to-length should be at least 1:2

Recommended dimensions for blood pressure cuff bladders

Age range	Width, cm	Length, cm	Maximum arm circumference, cm*
Newborn	4	8	10
Infant	6	12	15
Child	9	18	22
Small adult	10	24	26
Adult	13	30	34
Large adult	16	38	44
Thigh	20	42	52

* Calculated so that the largest arm would still allow the bladder to encircle arm by at least 80 percent.

Fourth report on the diagnosis, evaluation, and treatment of high blood pressure in children and adolescents. National Heart, Lung and Blood Institute. National Institutes of Health. May 2004.



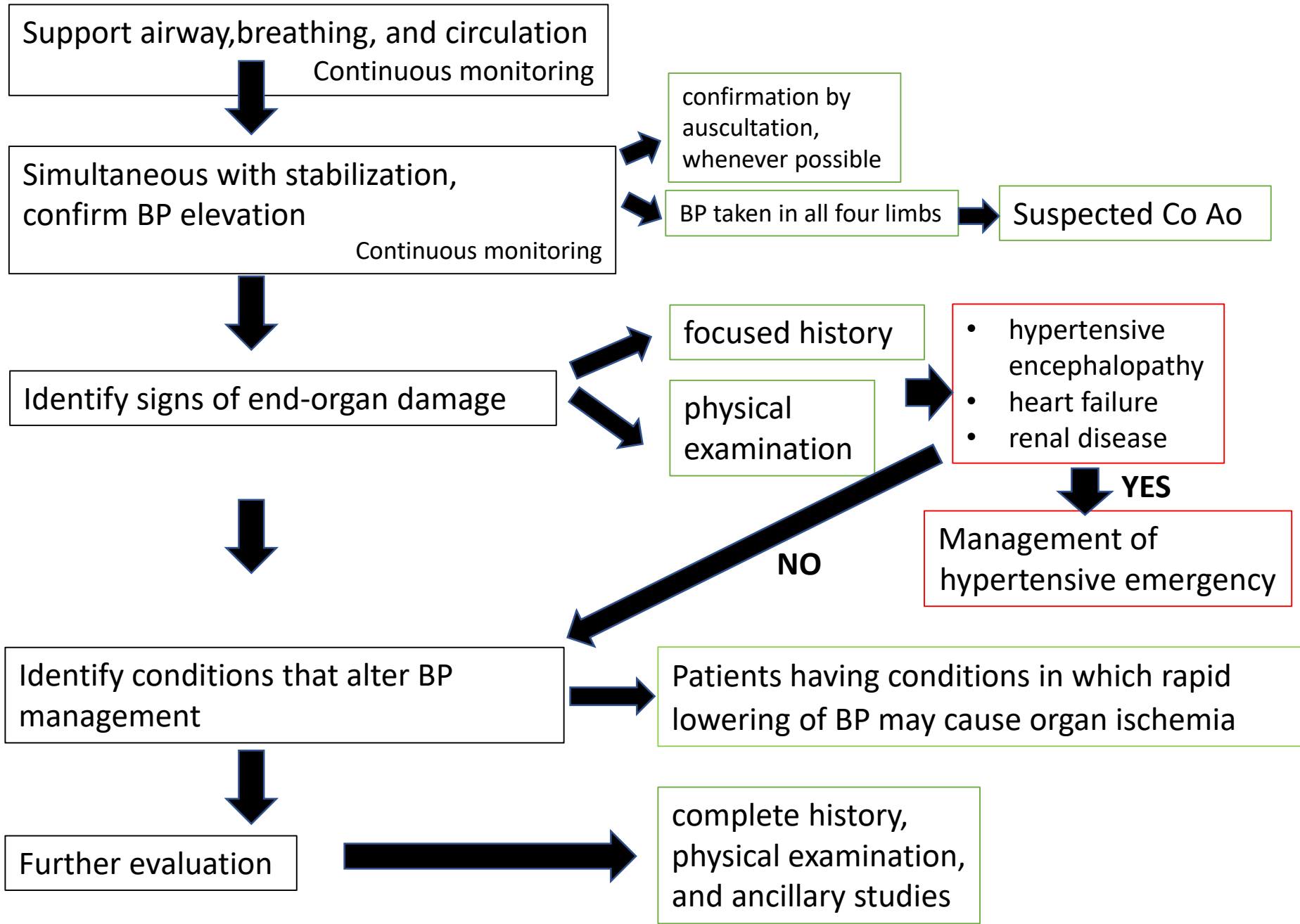
DURA-CUF

Size	Color	Limb Circumference	2-Tube Screw Connector
Infant	Orange	8-13 cm	002783
Child	Green	12-19 cm	002781
Child Long	Green	12-19 cm	2785
Small Adult	Royal Blue	17-25 cm	002779
Small Adult Long	Royal Blue	17-25 cm	
Adult w/ Hanger	Navy	23-33 cm	002771
Adult	Navy	23-33 cm	002774
Adult Long	Navy	23-33 cm	002772
Large Adult	Wine	31-40 cm	002791
Large Adult Long	Wine	31-40 cm	002784
Thigh	Brown	38-50 cm	002796

Trova l'errore!



Initial management of suspected hypertensive emergency



Signs of target-organ damage

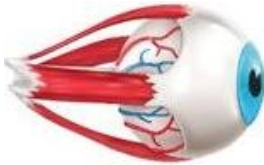
Central nervous system



Hypertensive encephalopathy

headache, altered mental status (lethargy, coma, or confusion), seizures, irritability (infants); facial nerve palsy, vision change, and hemiplegia

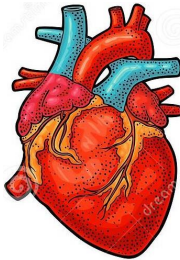
Eye



Fundusoscopic examination

papilledema
retinal hemorrhage

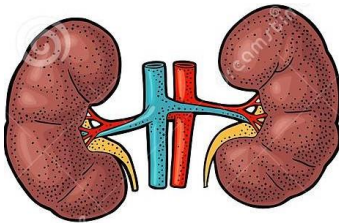
Heart



Heart failure

left ventricular heart failure (tachypnea, pulmonary edema, S3 or S4 gallop rhythm, and new or changed heart murmur)

Kidney



Glomerulonephritis

Fluid overload

Acute kidney injury

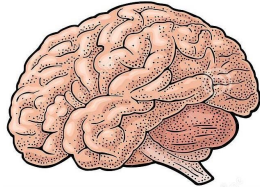
Hematuria and proteinuria

Peripheral edema

Hematuria, proteinuria, or flank pain.

Conditions that alter initial BP management

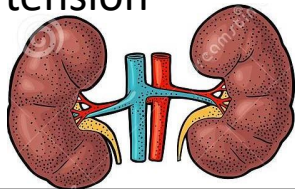
Patients with increased intracranial pressure



Head trauma
→ presence of a bulging fontanelle in infants, bruising, laceration, hemotympanum, palpable skull defect, or signs of impending hernia

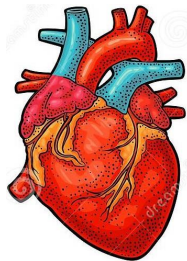
emergency neuroimaging prior to antihypertensive therapy to exclude mass lesion, hemorrhage, or stroke.

Patients with a history of chronic kidney disease and known hypertension



Nefrology consultant

Coarctation of the aorta



diminished femoral pulses, lower extremity BP that is less than upper extremity BP, or significant difference between right and left upper extremity

Cardiology consultant

Patients for whom rapid BP lowering is contraindicated

These patients have conditions in which rapid lowering of BP may cause organ ischemia



Patients who require therapy directed at the underlying cause	
Severe pain	analgesia
Preeclampsia or eclampsia	
Cocaine, amphetamine, or other sympathomimetic overdose	
Pheochromocytoma	intermittent headaches, flushing, tachycardia, palpitations, and diaphoresis.
Envenomation with sympathetic hyperactivity –scorpions or jellyfish	

ETIOLOGY OF HYPERTENSIVE EMERGENCY

Historically, hypertension in childhood and adolescence was thought to result largely from some other underlying disease process, typically involving the renal, cardiovascular, or endocrine system

More recently, primary hypertension has become much more prevalent in the pediatric population, particularly in older children. The ongoing obesity epidemic is almost certainly responsible for this evolving trend.

Causes of pediatric hypertensive emergencies and urgencies by age

	Infancy	Childhood	Adolescence
Umbelical- arterial catheterization	Renal vascular disease*	Renal parenchymal disease*	Renal parenchymal disease* glomerulonephritis
	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
iatrogenic	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)		

* Common causes of hypertensive emergency.

Adapted from: Constantine E. Hypertension. In: Textbook of Pediatric Emergency Medicine, 6th ed, Fleisher GR, Ludwig S, Henretig FM (Eds), Lippincott, Williams & Wilkins, Philadelphia 2010. p.315.

ETIOLOGY OF HYPERTENSIVE EMERGENCY

Renal

- Cystic dysplasia
- Autosomal recessive polycystic kidney disease
- Autosomal dominant polycystic kidney disease
- Reflux nephropathy
- Renal scarring
- Glomerulonephritis
- Renal vein thrombosis
- Renal artery stenosis
- Hemolytic uremic syndrome

Cardiovascular

- Coarctation of the aorta
- Midaortic syndrome
- Arteritis

Endocrine

- Cushing syndrome
- Hyperthyroidism
- Rare forms of congenital adrenal hyperplasia

Malignancy

- Neuroblastoma
- Pheochromocytoma
- Wilms' tumor

Medications/toxins

- Amphetamines
- Anabolic steroids
- Caffeine (newborns)
- Calcineurin inhibitors
- Cocaine
- Corticosteroids
- Erythropoietin
- Phenylephrine eye drops (newborns)
- Phenylpropanolamines
- Pseudoephedrine
- Theophylline (newborns)

Neurologic

- Central nervous system tumor
- Increased intracranial pressure
- Seizure
- Intracranial hemorrhage
- Autonomic dysfunction

Other

- Primary hypertension
 - Pregnancy
 - Gordon syndrome
 - Liddle syndrome
 - Apparent mineralocorticoid excess
 - Glucocorticoid-remediable aldosteronism
 - Medication noncompliance in known hypertensive patient
-

Clinical presentation

Children with severe hypertension may present in a number of forms, ranging from entirely asymptomatic to severely disabled.

Table 3 Presenting features in children with hypertensive crisis

Infants and young children (≤ 6 years)

Irritability
Feeding disturbance
Vomiting
Failure to thrive
Seizure activity
Altered mental status
Congestive heart failure

Older children (> 6 years) and adolescents

Headache
Dizziness
Acute visual disturbance
Facial nerve palsy
Chest tightness
Tachycardia/palpitations
Nausea/vomiting
Asymptomatic

ALERT

The **Cushing triad**

- Elevation of the systolic pressure
- Bradycardia
- Irregular respirations

found with increasing intracranial pressure from an intracranial injury or mass should be recognized as a separate entity and is a neurosurgical emergency

Complications associated with hypertensive crises are typically related to the cardiac, renal, and central nervous systems.

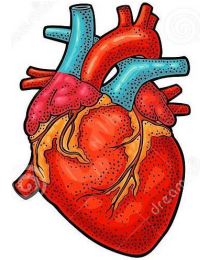
Clinical presentation



RED FLAGS

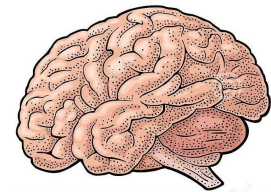
Infants in hypertensive emergencies often have symptoms of CHF

- Irritability
- Difficulty breathing
- Failure to thrive



Children with hypertensive emergencies will often have symptoms of hypertensive encephalopathy

- Severe headache
- Vomiting
- Seizures
- Ataxia
- Lethargy
- Confusion
- Visual disturbances.



Physical examination findings associated with possible etiology of hypertension in children and adolescents^[1-3]

Physical examination finding	Possible etiology
General	
Obesity	Essential hypertension
Truncal obesity	Cushing syndrome, corticosteroid therapy
Growth retardation	Chronic kidney disease
Vital signs	
Tachycardia	Catecholamine excess (PCC or neuroblastoma) or hyperthyroidism
BP differences in extremities	If upper extremity BP > lower extremity BP, coarctation of aorta
Head and neck	
Elfin facies	Williams syndrome
Moon facies	Cushing syndrome, corticosteroid therapy
Thyroid enlargement or goiter	Hyperthyroidism
Webbed neck	Turner syndrome
Tonsillar hypertrophy	Sleep-disordered breathing, sleep apnea
Eye	
Retinal changes	Suggest severe hypertension and secondary etiology
Papilledema	Increase intracranial pressure

Skin	
Pallor, flushing	Catecholamine excess (PCC and neuroblastoma)
Acne, hirsutism, striae	Cushing syndrome, corticosteroid therapy
Café-au-lait spots and/or neurofibromas	Neurofibromatosis
Ash leaf spots and/or adenoma sebaceum	Tuberous sclerosis
Rash	Lupus nephritis, Henoch-Schönlein purpura (IgA vasculitis)
Acanthosis nigricans	Type 2 diabetes
Chest	
Widely spaced nipples	Turner syndrome
Murmur	Coarctation of the aorta
Apical heave	Left ventricular hypertrophy
Abdomen	
Abdominal bruit	Renovascular disease
Mass	Hydronephrosis, polycystic kidney disease, renal tumors, neuroblastoma
Extremities	
Traction/casts	Orthopedic manipulation
Asymmetry of limbs	Beckwith-Wiedemann syndrome
Arthritis	Henoch-Schönlein purpura (IgA vasculitis), collagen vascular disease (systemic lupus erythematosus)
Neurologic	
Muscle weakness	Liddle syndrome, hyperaldosteronism
Diminished pain response	Familial dysautonomia
Genitalia	
Ambiguous/virilization	Adrenal hyperplasia
Advanced puberty	Intracranial tumors

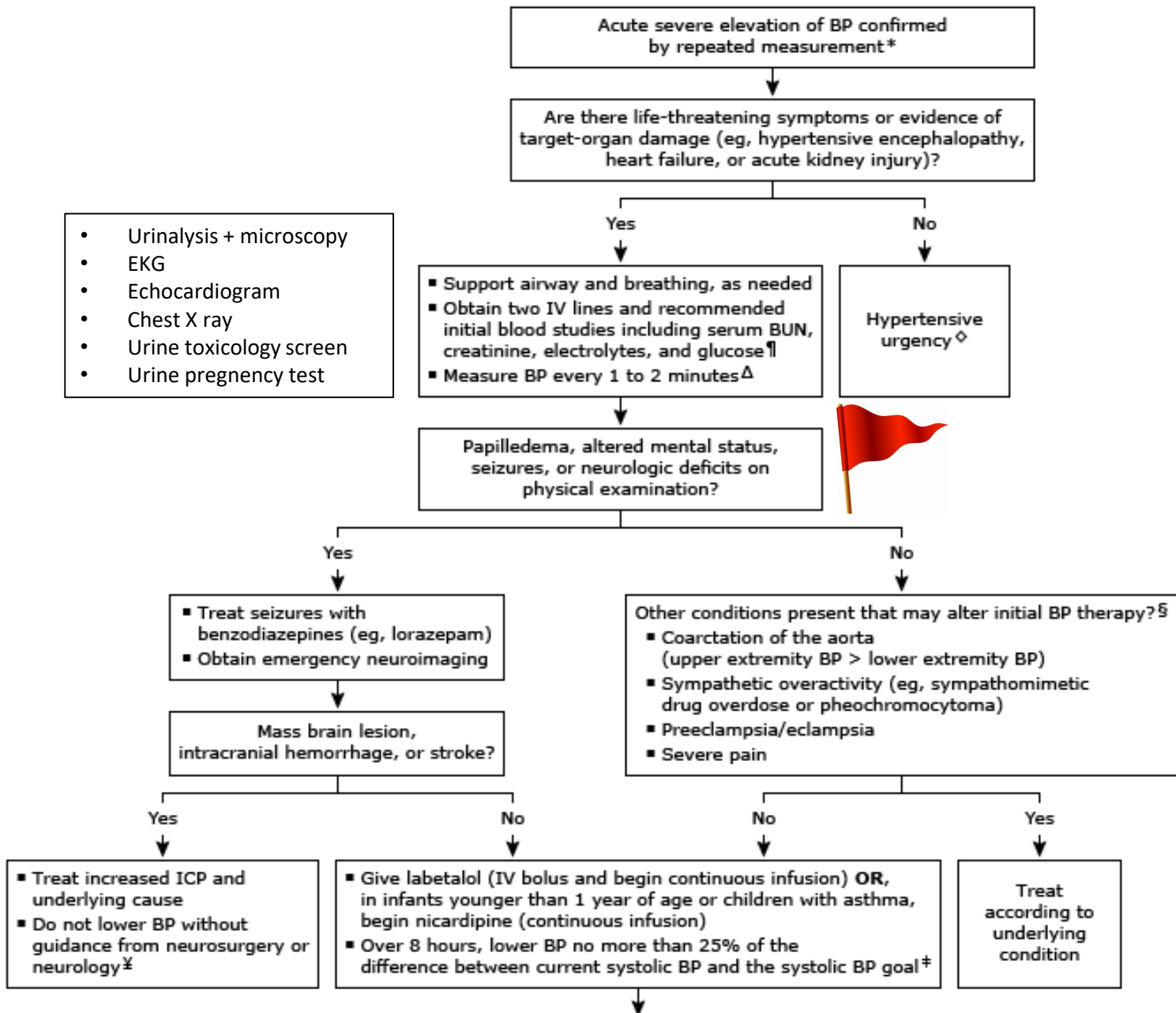
PCC: pheochromocytoma; BP: blood pressure.

References:

1. Flynn JT. Evaluation and management of hypertension in childhood. *Prog Pediatr Cardiol* 2001; 12:177.
2. The Fourth Report on the Diagnosis, Evaluation, and Treatment of High Blood Pressure in Children and Adolescents. National Heart, Lung, and Blood Institute. National Institutes of Health. May 2004.
3. Flynn JT, Kaelber DC, Baker-Smith CM, et al. Clinical Practice Guideline for Screening and Management of High Blood Pressure in Children and Adolescents. *Pediatrics* 2017; 140:e20171904.

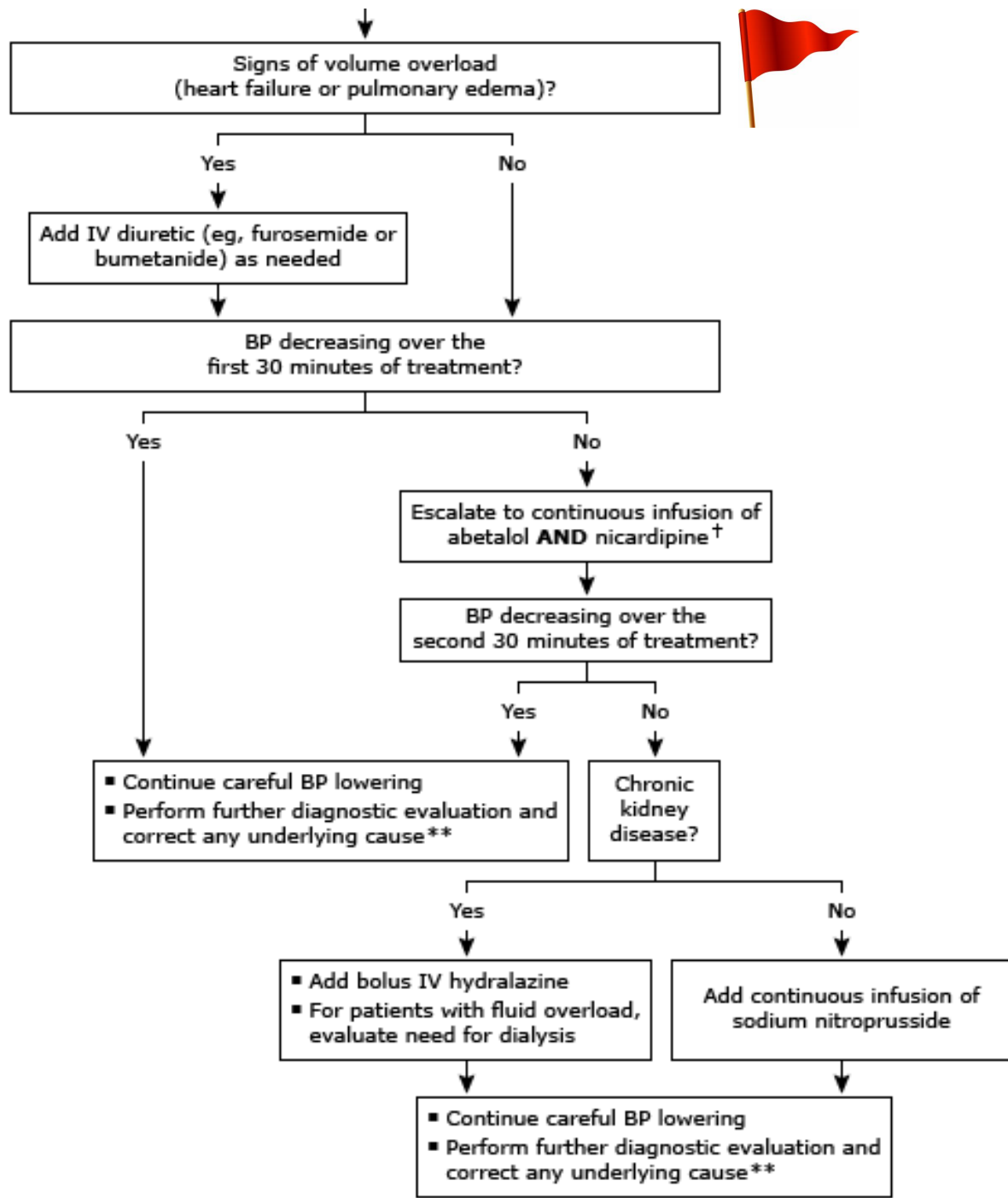
Ancillary studies	
Measurement of blood urea nitrogen (BUN), serum creatinine, electrolytes, and glucose; and urinalysis with microscopy	Assess renal function
Complete blood count and reticulocyte count	Possible anemia or thrombocytopenia often associated with hemolytic uremic syndrome and rheumatic disorders
Chest radiograph and electrocardiogram	Cardiac hypertrophy and heart failure.
Emergency neuroimaging	Intracranial hemorrhage, mass brain lesion, or stroke
Urine toxicological screen testing	Amphetamines, phencyclidine, and metabolites of cocaine
Echocardiography	Left ventricular mass and function

Initial management of hypertensive emergencies in children and adolescents

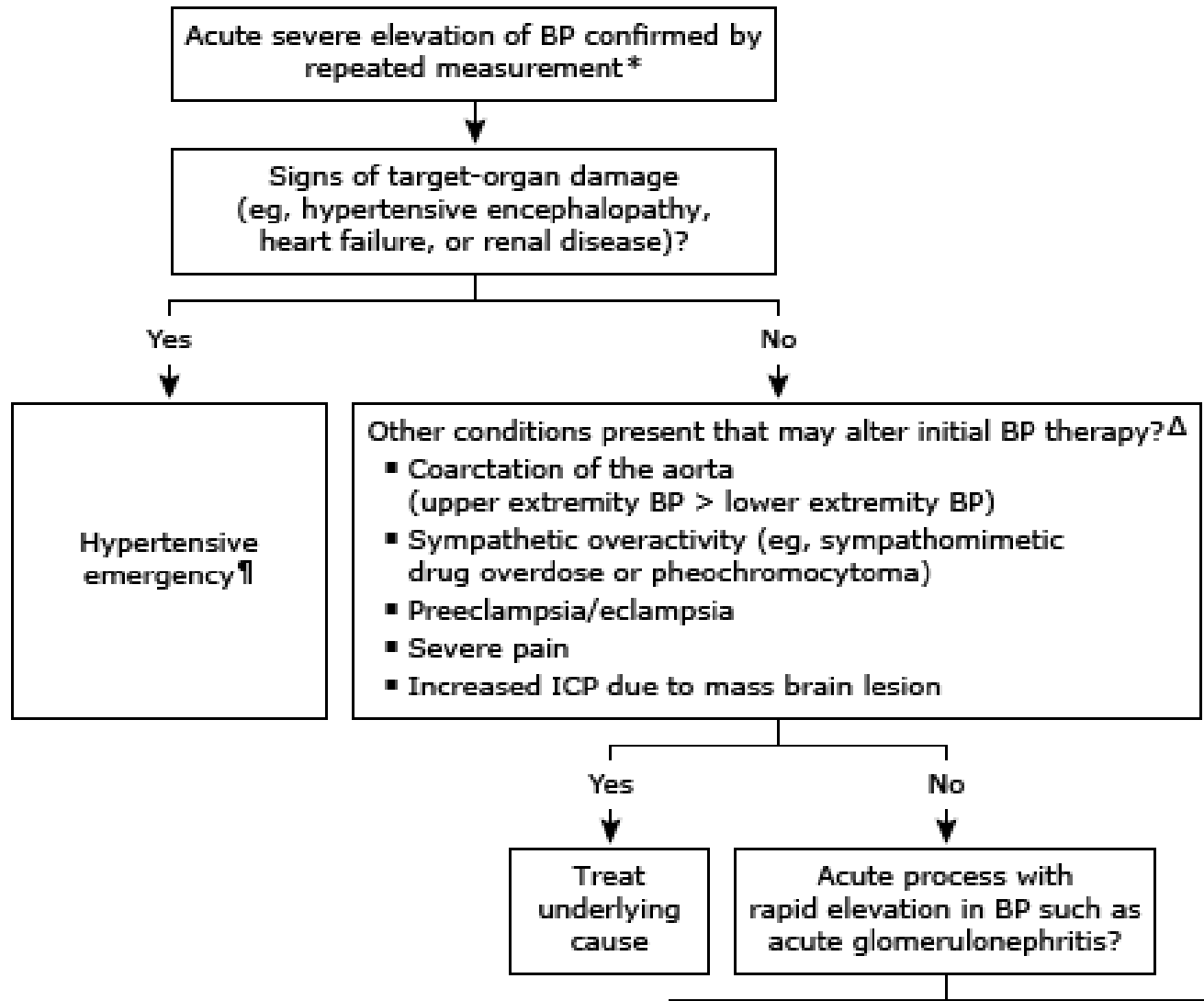


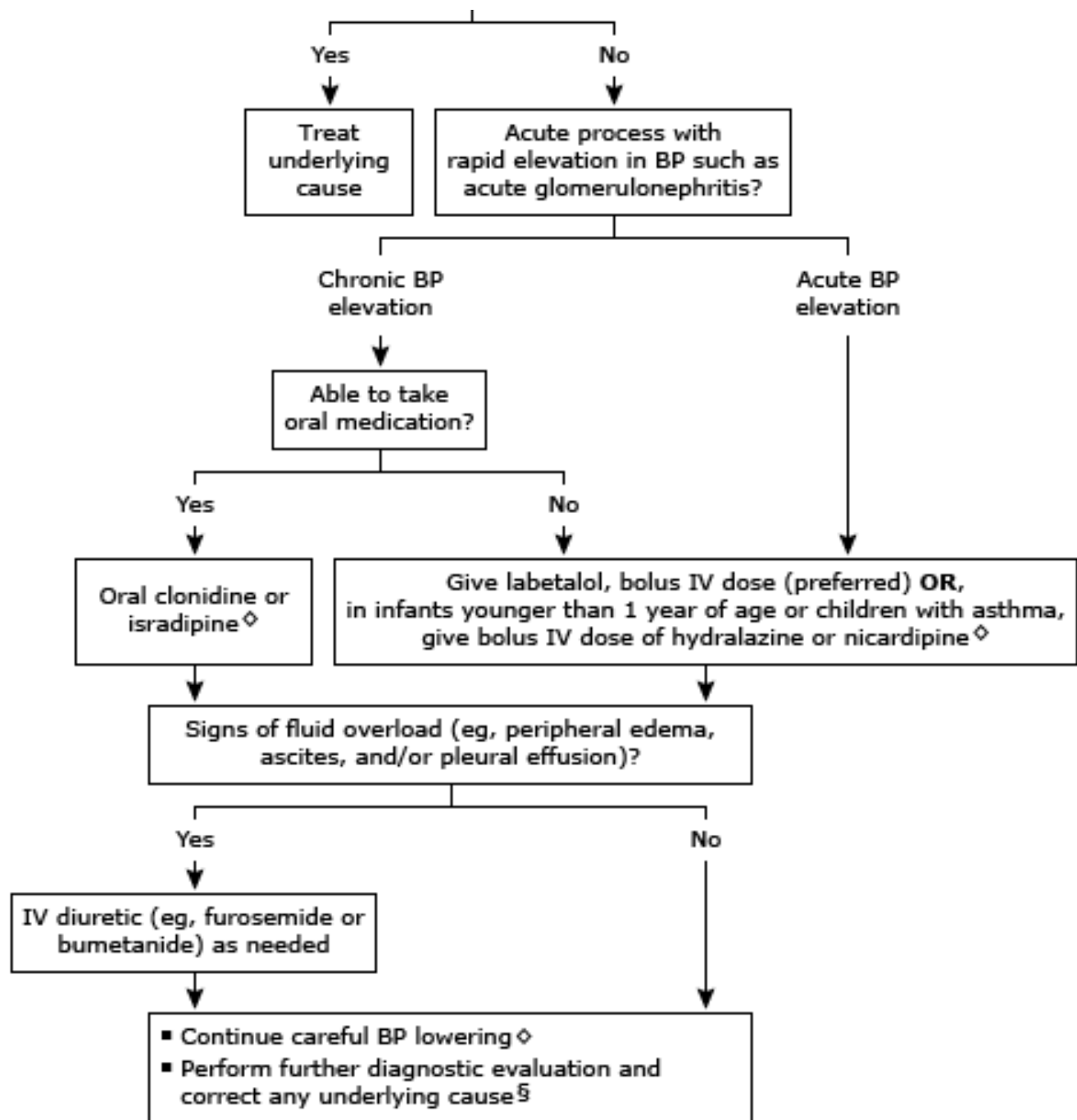
- Urinalysis + microscopy
- EKG
- Echocardiogram
- Chest X ray
- Urine toxicology screen
- Urine pregnancy test





Initial management of hypertensive urgencies in children and adolescents





TREATMENT

Recommendations to lower the BP to

- less than the 95th percentile in children with hypertension and no end-organ damage and
- less than the 90th percentile in children with end-organ damage, secondary hypertension, and/or comorbid conditions such as underlying renal disease, heart disease, or diabetes.

Reasonable approach to BP reduction in children :

the BP should be reduced by 25% of the planned reduction over the first 8–12 hours, a further 25% over the next 8–12 hours, and the final 50% over the following 24 hours.

Infusion rates should be titrated to achieve the desired BP reduction of no more than 25 percent of the total planned systolic BP reduction (difference between the current systolic BP and the goal systolic BP) while avoiding additional symptomatic BP increases

TREATMENT



Whenever possible, an experienced clinician such as a pediatric nephrologist or intensivist should guide therapy of pediatric hypertensive emergencies once emergency stabilization is accomplished

Antihypertensive medications for management of hypertensive crisis in children

Intravenous Enalaprilat	ACE inhibitor	Bolus dosing: 0.05–0.1 mg/kg per dose, up to 1.25 mg per dose	Onset of action: ≤ 15 minutes Adverse effects: acute kidney injury, hyperkalemia, hypotension Other: neonates are at increased risk for prolonged hypotension and acute kidney injury
Esmolol	β-Blocker Ultra short acting Cardiosel	Continuous infusion: loading dose 100–500 µg/kg, then 50–300 µg/kg/min (continuous infusion)	Onset of action: < 1 minute Adverse effects: bradycardia, decreased cardiac output, bronchospasm Other: use with caution in patients with heart failure due to negative inotropic effects
Fenoldopam	Dopamine (D ₁ -receptor) agonist	Continuous infusion: 0.2–0.8 µg/kg/min	Onset of action: 10 minutes Adverse effects: tachycardia, headache, nausea, flushing, hypotension, hypokalemia Other: putative benefit of increasing renal perfusion
Hydralazine	Vasodilator	Bolus dosing: 0.1–0.6 mg/kg per dose, up to maximum 1.7–3 mg/kg/d divided in four to six doses (not to exceed 20 mg per dose)	Onset of action: 5–20 minutes Adverse effects: hypotension, reflex tachycardia, flushing, headaches, lupus-like syndrome Other: use with caution due to risk of precipitous drop in BP; paradoxical rise in BP may be observed in setting of renin-mediated hypertension
Labetalol	Alpha- and beta-blocker	Bolus dosing: 0.2–1 mg/kg per dose, up to a maximum of 40 mg per dose; continuous infusion: 0.2–3 mg/kg/h	Onset of action: 2–5 minutes Adverse effects: hypotension, dizziness, nausea, bradycardia, bronchospasm Other: use should be avoided in those with heart failure or reactive airway disease
Nicardipine	CCB	Continuous infusion: 0.5–3 µg/kg/min	Onset of action: within minutes Adverse effects: reflex tachycardia, peripheral edema Other: use with caution in those with heart failure due to negative inotropic effect Central access is preferred for infusion due to risk of injection site reaction
Sodium nitroprusside	Vasodilator	Continuous infusion: 0.5–10 µg/kg/min	Onset of action: < 2 minutes Adverse effects: hypotension, palpitations, flushing Other: monitor for cyanide toxicity with prolonged use or when administered in those with concomitant renal or liver failure

FDA approved

Coadministration of thiosulfate

isradipine has emerged as the oral antihypertensive medication of choice for use in pediatric hypertensive crises by some providers,³

Table 6 Antihypertensive medications for management of hypertensive crisis in children

Medication	Class	Dose	Comments
Oral			
Clonidine	Central α -agonist	0.05–0.1 mg per dose to maximum dose of 0.8 mg total dose	Onset of action: 30–60 minutes Adverse effects: sedation, bradycardia Other: risk of rebound hypertension if standing doses are withdrawn abruptly
Isradipine	CCB	0.05–0.1 mg/kg per dose, up to 5 mg per dose	Onset of action: 1 hour Adverse effects: headache, nausea, flushing, hypotension Other: available as extemporaneously prepared suspension → Infant and toddlers
Minoxidil	Vasodilator	0.1–0.2 mg/kg per dose	Onset of action: 30 minutes Adverse effects: EKG (T-wave) changes, edema, and hypertrichosis with chronic use Other: long duration of action
Nifedipine	CCB	0.1–0.25 mg/kg per dose up to 10 mg per dose	Onset of action: 1–5 minutes (bite and swallow); within 20–30 minutes, if capsule taken whole Adverse effects: hypotension, flushing, tachycardia, syncope Other: current pediatric guidelines do not recommend use

The safety, efficacy, and pharmacokinetics of esmolol for blood pressure control immediately after repair of coarctation of the aorta in infants and children: A multicenter, double-blind, randomized trial

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The pharmacodynamics and pharmacokinetics of esmolol have been well characterized in children and found to be similar to those in older patients, although drug elimination has been shown to be more rapid in younger age groups. In case reports and small series, esmolol has been found to be safe and effective in hypertensive children, particularly in those with elevated BP in the postoperative period following cardiac surgery.

A recent multicenter double-blind randomized trial showed that esmolol was safe and effective in reducing BP at low (125 µg/kg), medium (250 µg/kg), and high (500 µg/kg) doses in infants and young children following repaired coarctation of the aorta, although no dose response was demonstrated.⁴⁶

Evaluation of the safety and efficacy of metoprolol infusion for children and adolescents with hypertensive crises: a retrospective case series

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Metoprolol belongs to the β -blocker class of drugs. It has been safely used in adults [26] and has also been used in the oral form in children [17]. It is generally a safe medication with minimal side effects; **the main concern when using this drug is bradycardia** [27]. Other side effects include dizziness and constipation, but these are not sufficiently significant to warrant ceasing its use. Clinicians have been reluctant to initiate beta-blocker treatment in patients with obstructive airway disease due to the concern that the pulmonary disease may be exacerbated. **Metoprolol is a cardio-selective beta blocking** agent which is at least 20-fold more potent at blocking β -1 than β -2 receptors. When used in therapeutic doses it has negligible bronchoconstrictive effect.

In our retrospective case studies, metoprolol infusion at a dose of 3–5 mcg/kg/min was used safely. The dose was tapered slowly starting at 0.5 mcg/kg/min, and it was increased every 30 min to reach the desired effect (Fig. 1). The BP decreased slowly within the safe range set by the guidelines [1].

PEARLS AND PITFALLS

Pearls:

- Obtain a BP reading on any newborn or infant presenting with failure to thrive and irritability.
- Obtain a BP reading on both upper and lower extremities when an elevated BP is found.
- Triage BP measurements may be factitiously elevated and should always be repeated.
- “White coat” HTN should not be discounted, and follow-up with a primary care physician is recommended.

Pitfalls:

- Failure to obtain the BP measurement using an appropriately sized cuff in the right arm
- Failure to recognize hypertensive encephalopathy in a child presenting with altered mental status

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Grazie per l'attenzione!

