

Hypertension in children and adolescents



This guideline has been endorsed by the Paediatric improvement Collaborative



See also

Online paediatric BP centile calculator (<https://www.mdcalc.com/aap-pediatric-hypertension-guidelines#pearls-pitfalls>)

BP by age and height centile tables: [boys](https://publications.aap.org/view-large/7674617) (<https://publications.aap.org/view-large/7674617>), [girls](https://publications.aap.org/view-large/7674618) (<https://publications.aap.org/view-large/7674618>)

Key points

1. Severe hypertension requires urgent consultation and management. Hypertension associated with encephalopathy is a medical emergency
2. All hypertension in children requires monitoring and follow-up
3. Blood pressure should be measured annually in healthy children
4. Where possible, abnormal machine BP measurement should be confirmed, preferably with a manual BP, ensuring appropriately sized cuff is used for accurate measurement

Background

- This guideline will focus on the paediatric population aged 1–17 years (not infants)
- Hypertension in childhood is a key predictor of risk for hypertension, cardiovascular disease and end organ damage in adulthood
- Primary/essential hypertension accounts for the majority of hypertension in children >6 years old and is generally associated with obesity or a family history of hypertension
- Secondary hypertension is more common in younger children (<6 years old) with renal disease being the most prevalent cause. This population is at greater risk of hypertensive emergencies due to an underlying condition

Assessment

Risk factors

- Overweight/obesity
- Male sex
- Family history of hypertension
- Low birth weight/intrauterine growth restriction
- Prematurity
- Excess dietary salt intake

- Physical inactivity
- Chronic health concerns, eg chronic kidney disease, diabetes

Causes of Hypertension	
Primary Hypertension	
Situational Hypertension	
Stress, pain, anxiety	
Secondary Hypertension	
Renal parenchymal disease	GN, polycystic kidneys, CKI
Cardiac, Vascular	Renal artery stenosis, Coarctation repair (pre and post)
Endocrine	Diabetes, thyroid disease, CAH, Diabetes, thyroid disease, CAH, Cushings
Autoimmune	Thrombotic thrombocytopenic purpura, Haemolytic Uraemic Syndrome, <u>Henoch-Schönlein Purpura</u> (https://www.rch.org.au/clinicalguide/guideline_index/HenochSchonlein_Purpura/).
Genetic/Syndromic	Neurofibromatosis, Williams Syndrome, Turners Syndrome
Malignancy	Wilms tumour, neuroblastoma, pheochromocytoma
Intracranial pathology	Intracranial haemorrhage/stroke, pituitary adenoma, raised ICP
Respiratory	Chronic lung disease, OSA
Drug-induced	Corticosteroids, OCP, stimulants

History

- Headache/vomiting
- Blurred vision
- Change in mental state
- Seizures
- Chest pain/palpitations
- Shortness of breath
- Cardiac failure

- Past history of Acute Kidney Injury (AKI)

Examination

- Confirm hypertension (See measuring blood pressure section below)
- Vitals: tachycardia, four limb BP for upper and lower limb discrepancy
- Height and weight: obesity, growth retardation
- Signs of end organ damage
 - Fundoscopy: hypertensive retinopathy
 - Cardiovascular: apical heave, hepatomegaly, oedema
 - Chronic renal failure: palpable kidneys
 - Focal neurology eg facial nerve palsies
- Signs of underlying cause
 - General appearance: Cushingoid, proptosis, goitre, webbed neck (Turner syndrome), elfin facies (William syndrome)
 - Skin: Cafe-au-lait spots, neurofibromas, acanthosis nigricans, hirsutism, striae, acne, rash (vasculitis)
 - Cardiovascular: murmurs +/- radiation, apical heave, reduced femoral pulses, oedema, hepatomegaly (CCF)
 - Abdomen: masses, palpable kidneys, flank bruits
 - Genitourinary: ambiguous/virilised genitalia eg CAH

Key points when measuring blood pressure ([See video](https://www.broadcastmed.com/cardiology/3979/videos/blood-pressure-measurement-in-children)) (<https://www.broadcastmed.com/cardiology/3979/videos/blood-pressure-measurement-in-children>)

Ensure the correct cuff size is selected for each patient, favouring a larger rather than smaller cuff (smaller cuff creates artificial hypertension)

- BP cuff width should be 40% of the length of the arm measure from the shoulder tip to the elbow
- Abnormal oscillatory BP measurement needs checking with a manual BP from the child's arm

The table below identifies BP levels requiring further evaluation, starting with repeating the BP manually ensuring accurate measurement

*Screening BP Values Requiring Further Evaluation				
Age (years)	Blood pressure (mmHg)			
	Boys		Girls	
	Systolic	Diastolic	Systolic	Diastolic
1	98	52	98	54
2	100	55	101	58
3	101	58	102	60
4	102	60	103	62
5	103	63	104	64

6	105	66	105	67
7	106	68	106	68
8	107	69	107	69
9	107	70	108	71
10	108	72	109	72
11	110	74	111	74
12	113	75	114	75
≥13	120	80	120	80

*90th centile for a child at average height

Assessment of severity

Interpreting blood pressure measurement

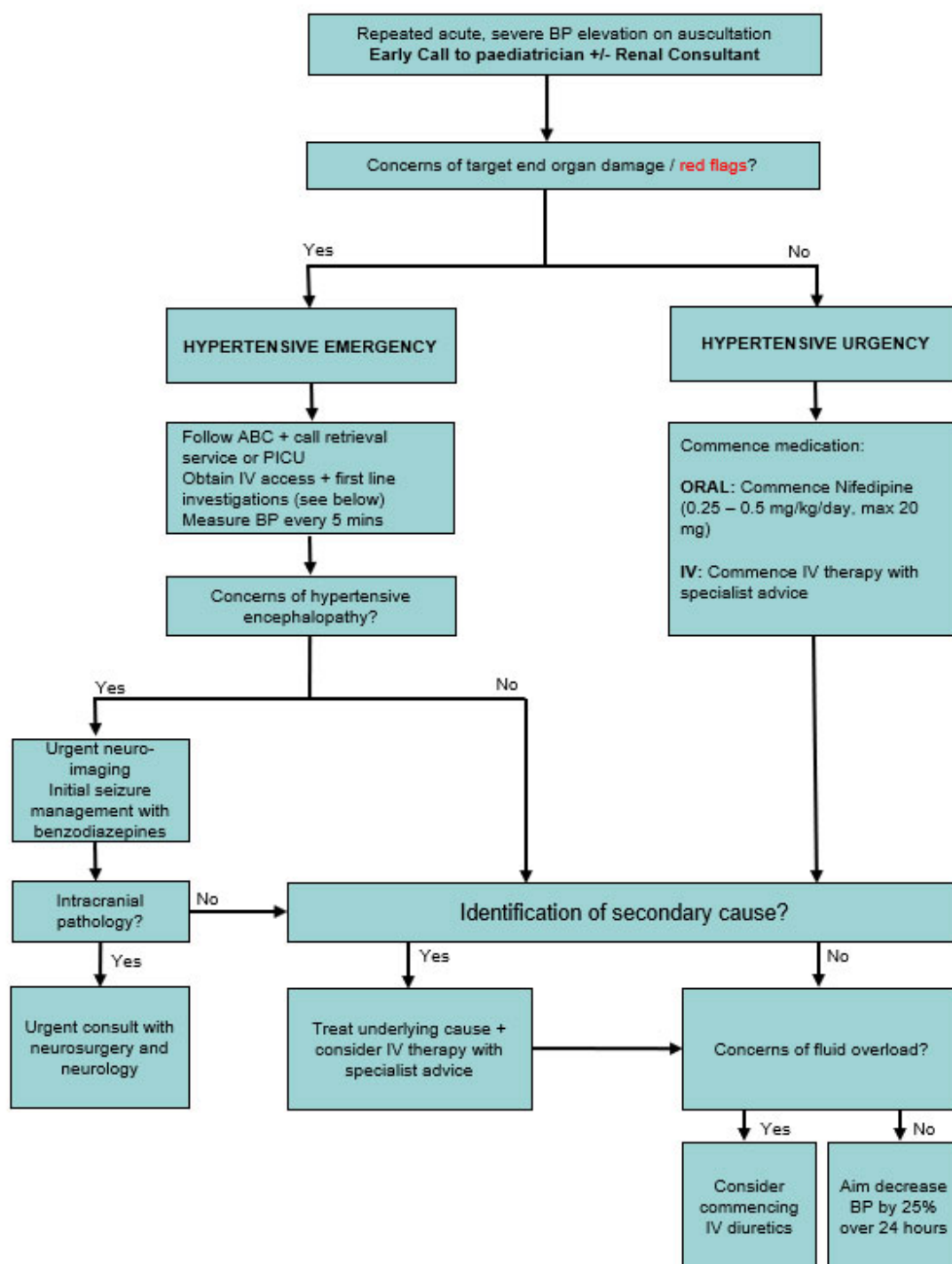
An [online blood pressure centile calculator \(https://www.mdcalc.com/aap-pediatric-hypertension-guidelines#pearls-pitfalls\)](https://www.mdcalc.com/aap-pediatric-hypertension-guidelines#pearls-pitfalls) specific for gender, age and height can be used to determine the severity of hypertension

Blood pressure classification in children and adolescents		
	For children aged 1 to 13 years	For children aged 13-17 years
Normal blood pressure	<90 th centile	<120/<80 mmHg
Elevated blood pressure	≥90 th centile to <95 th centile or 120/80 mmHg to <95 th centile (whichever is lower)	120/<80 to 129/<80 mmHg
Stage 1 Hypertension	≥95 th centile to <95 th centile + 12 mmHg or 130/80 to 139/89 mmHg (whichever is lower)	130/80 to 139/89 mmHg
Stage 2 Hypertension	≥95 th centile + 12 mmHg, or ≥140/90 mmHg (whichever is lower)	≥140/90 mmHg
Severe Hypertension		
Hypertensive Urgency	>95 th centile + 30 mmHg without symptoms/signs of target end organ damage (See Examination)	>180/120 without symptoms/signs of target end organ damage (See Examination)

Hypertensive Emergency	>95 th centile + 30 mmHg associated with encephalopathy, eg headache vomiting, vision changes and neurological symptoms (facial nerve palsy, lethargy, seizures, coma) +/- target-end organ damage	>180/120 associated with encephalopathy, eg headache vomiting, vision changes and neurological symptoms (facial nerve palsy, lethargy, seizures, coma) +/- target-end organ damage
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Management

Emergency management of severe hypertension



- Discuss with renal team and retrieval/ICU team

Hypertensive urgency

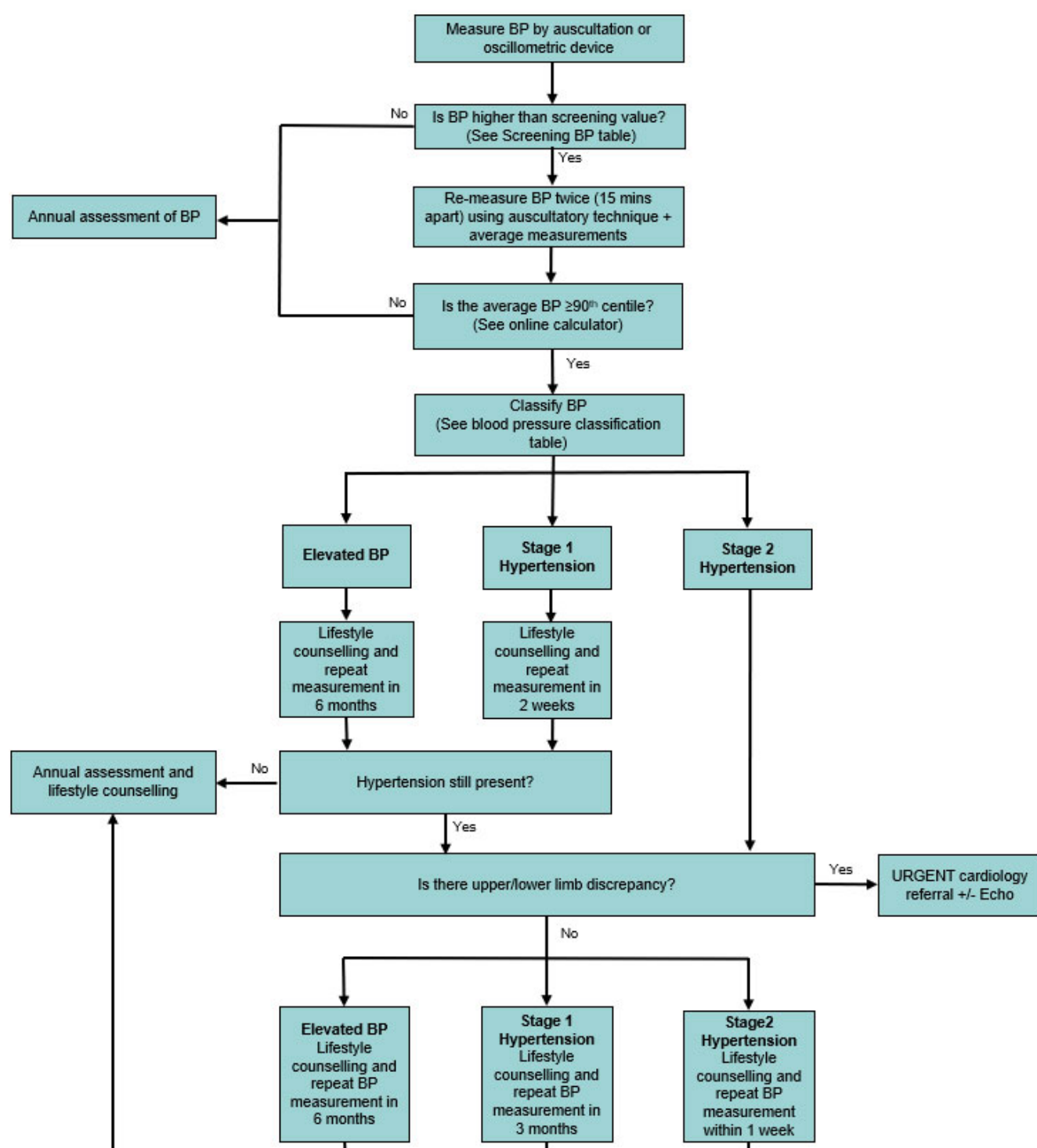
If medically stable, consider short acting oral agents while investigating cause

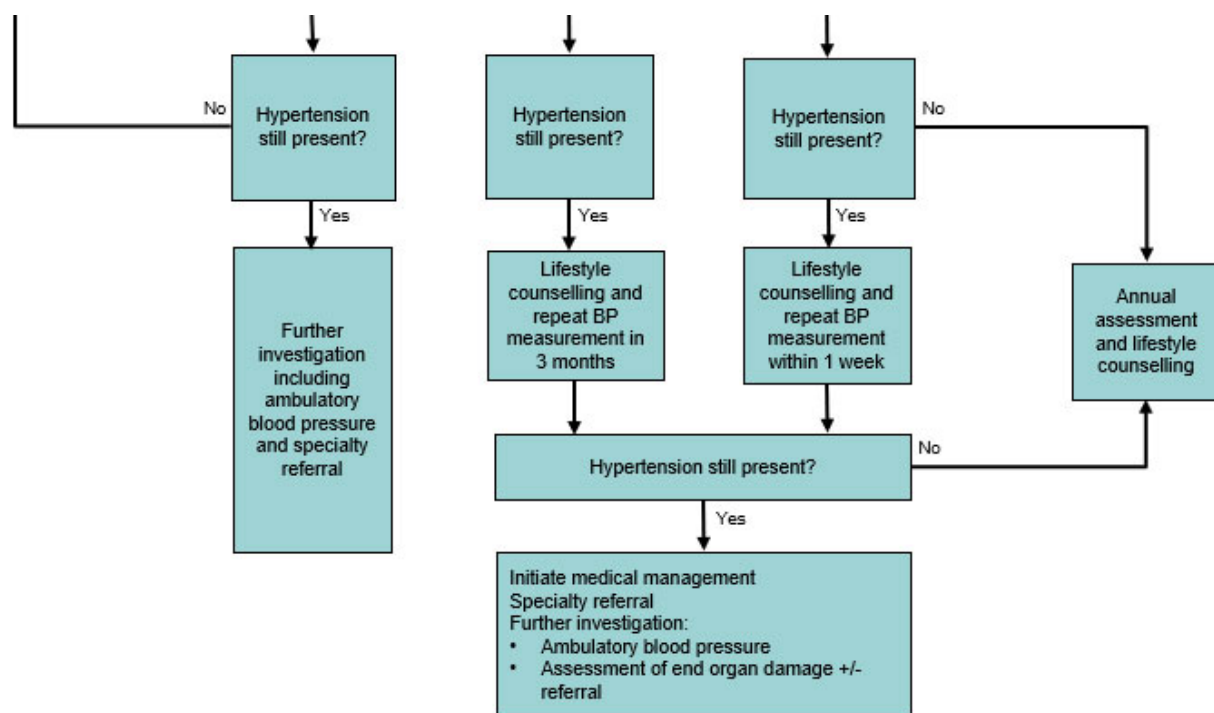
- Nifedipine
- Commence 0.25–0.5 mg/kg/day (max 20 mg) and titrate up as required to a maximum of 3 mg/kg/day (max 120 mg)

Hypertensive emergency

- Intravenous therapy; discuss with renal team and retrieval/ICU team
- Aim to gradually reduce BP to the patient's estimated 95th centile
- Decrease BP by 25% of the original value every 24 hours till target BP reached. Reduce rate of decrease if patient becomes symptomatic

Hypertension without severe features





Investigations

First-line investigations

- UEC, CMP, urinalysis +/- renal ultrasound
- Consider LFT, Hb1Ac, fasting lipids particularly in children with BMI >95th centile

Further investigations should only be considered in consultation with a general or renal paediatrician

Consider further testing if child meets one of the following criteria:

- <6 years
- Concerns for secondary causes on history/examination
- Abnormal first-line investigations

Further Investigations

- Bloods: FBE, Bicarbonate, renin/aldosterone ratio, TFT, plasma metanephryns, cortisol, fasting glucose
- Urine: microscopy, protein/creatinine ratio, catecholamines, drug screen
- Imaging: renal doppler ultrasound, DMSA, CTA/MRA
- Other: echocardiogram, sleep study

Lifestyle counselling

Dietary modifications

- Rich in fresh fruit and vegetables/legumes, fish, poultry, lean red meat and low fat dairy
- Limit intake of high sodium, fat or sugar containing foods

Lifestyle modifications

- Increase physical activity, aiming 40 minutes moderate to vigorous exercise 3-5 days/week
- Consider counselling/behavioural techniques to help address weight management and metabolic risk

Medical management

Should be commenced if:

- Conservative measures have failed
- Symptomatic hypertension develops
- Stage 2 hypertension with no modifiable risk factors
- Hypertension in setting of chronic kidney disease/diabetes

Medical management should only be commenced in consultation with a general or renal paediatrician

- Long-acting calcium channel blockers such as amlodipine are recommended as first line therapy. Other medication may be preferred in children with BMI >95th centile, diabetes or proteinuria

Consider consultation with local paediatric team when

- Red flags (see history section above) or ongoing concerns are present
- Hypertensive urgency or hypertensive emergency
- Medical management of hypertension is required

Consider transfer when

Child requiring care beyond the comfort level of the hospital

For emergency advice and paediatric or neonatal ICU transfers, see **Retrieval Services** (https://www.rch.org.au/clinicalguide/guideline_index/Retrieval_services/).

Consider discharge when

Hypertensive children without severe features may be discharged with appropriate follow-up (See flowchart)

Parent information

See [Parent resources](https://www.rch.org.au/clinicalguide/guideline_index/Parent_Resources/) (https://www.rch.org.au/clinicalguide/guideline_index/Parent_Resources/).

Additional notes

[How to Measure Blood Pressure – American Academy of Pediatrics](https://www.broadcastmed.com/cardiology/3979/videos/blood-pressure-measurement-in-children) (<https://www.broadcastmed.com/cardiology/3979/videos/blood-pressure-measurement-in-children>) (video)

Last updated June 2021

➤ Reference List

Dionne, J. Updated guideline may improve the recognition and diagnosis of hypertension in children and adolescents; review of the 2017 AAP blood pressure clinical practice guideline. *Current Hypertension Reports*. 2017. vol 19 (10), p84.

Flynn, J.T et al. Clinical practice guideline for screening and management of high blood pressure in children and adolescents. *Pediatrics*. 2017 vol 140 (3)