

Hypertension

Definition / Supporting Information

In children and adolescents, hypertension is defined as elevated blood pressure (BP) that persists on repeated measurement at the 95th percentile or greater for age, height, and sex in a healthy population.

Marked increases in systolic and diastolic BP and signs of papilloedema and/or retinal haemorrhage is a medical emergency (see Hypertensive Emergencies)

Normal systolic and diastolic BPs: < 90th percentile for age, height, and sex.

High-normal BP or pre-hypertension: between the 90th and 95th percentiles.

Stage 1 hypertension: systolic and diastolic BPs are between the 95th percentile and 5 mmHg above the 99th percentile.

Stage 2 hypertension: systolic and diastolic BPs are 5 mmHg above the 99th percentile.

Blood pressure measurement:

- To confirm hypertension perform a manual BP reading with auscultation
- Choose an appropriately sized cuff (wide enough to cover $\geq 40\%$ of the upper arm and long enough to cover $\geq 80\%$ of the circumference of the arm).
- Measure BP with the child in a seated position and their arm supported, after he or she has been sitting quietly for 5 minutes (or, for an infant, lying supine)
- Confirm hypertension with an average of measurements on three separate days
- Measure height and plot on a growth chart to establish the height percentile
- Determine BP percentile using blood pressure and height percentiles by age [[The Fourth Report on the Diagnosis, Evaluation, and Treatment of High Blood Pressure in Children and Adolescents](#)] or for infants under 1 year see Figure 1 – Blood pressure centiles for infants aged 0–12 months.

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Figure 1: Age-, sex-, height-, and weight-specific percentiles of systolic and diastolic blood pressure in boys (left) and girls (right) from birth to 12 months of age. Task Force on Blood Pressure Control in Children. Report of the Second Task Force on Blood Pressure Control in Children—1987. *Pediatrics*. 1987;79(1):1-25

Keywords / also known as: arterial hypertension, high blood pressure

Essential History

Ask about:

- Neonatal history
 - Prematurity
 - Umbilical catheter insertion
 - Bronchopulmonary dysplasia
 - Patent ductus arteriosus
- History of renal disease and urinary tract infections
- Congenital heart defects
- Cardiovascular risk factors
- Review of symptoms
- Family history
 - Primary hypertension
 - Systemic disease
 - Endocrinopathy
- Medications and drugs
 - Corticosteroids eg, Prednisolone
 - Oral contraceptives
 - Illicit drugs
 - Tobacco
 - Alcohol
- Diet and salt intake

‘Red Flag’ Symptoms and Signs

Ask about:

- Neurological symptoms
 - Headaches (including characterisation)
 - Visual disturbances
 - Behavioural change
 - Altered mental status
 - Drowsiness
 - Seizures
- Nausea and / or vomiting
- Urinary symptoms
 - Polyuria
 - Oliguria or anuria

- Haematuria
- Cardiac symptoms
 - Chest pain
 - Palpitations
 - Oedema (eg, puffiness of eyes, swelling of feet)
 - Breathlessness (see Dyspnoea)
- Poor growth and / or weight loss

Look for:

- Signs of heart failure
 - Tachycardia
 - Gallop rhythm
 - Hepatomegaly
- Absent or weak femoral pulses
 - If detected measure four limb blood pressure
- Neurological deficit
- Papilloedema and / or retinal haemorrhages
- Organomegaly and / or abdominal masses
- Signs of thyroid disease
 - Goitre
- Carotid, abdominal, and femoral bruits
- Obesity (See the NHS [BMI Calculator](#))

Differential Diagnosis / Conditions

- Primary hypertension
 - May be seen in patients with:
 - Obesity
 - A positive family history of hypertension or cardiovascular disease
- Secondary hypertension in neonates and infants may have the following causes:
 - Renal
 - Renal artery thrombosis after umbilical artery catheterisation
 - Congenital renal parenchymal or structural disease
 - Renal artery stenosis
 - Bronchopulmonary dysplasia
 - Cardiac
 - Coarctation of the aorta
 - Patent ductus arteriosus
 - Increased intracranial pressure
 - Previous extracorporeal membrane oxygenation (ECMO)

- Secondary hypertension in children and adolescents may have the following causes:
 - Renal
 - Renal parenchymal disease
 - Renal artery stenosis
 - Acute post-streptococcal glomerulonephritis
 - Membranoproliferative glomerulonephritis
 - Diffuse proliferative glomerulonephritis
 - Lupus nephritis
 - Immunoglobulin A nephropathy
 - Haemolytic-uraemic syndrome
 - Nephrotic syndrome
 - Reflux nephropathy
 - Polycystic kidney disease
 - Wilms' tumour
 - Cardiac
 - Coarctation of the aorta
 - Obstructive sleep apnoea
 - Endocrine disorders
 - Mineralocorticoid excess
 - Hyperthyroidism
 - Pheochromocytoma
 - Hypercalcaemia
 - Adrenal cortical hyperplasia
 - Nervous system disorders
 - Tumours
 - Increased intracranial pressure
 - Drug-related causes
 - Immunosuppressants, antidepressants, sympathomimetics, NSAIDs.

Investigations

To be undertaken by non-specialist practitioners (eg, General Practitioner (GP) Team) or by specialist practitioners (eg, Emergency Department / Paediatric / Paediatric Nephrology Team(s)):

- Urinalysis
- ECG
- Full blood count
- Serum electrolytes
- Glucose
- Lipid profile

- Thyroid function tests

To be undertaken by specialist practitioners (eg, Emergency Department / Paediatric / Paediatric Nephrology Team(s)):

- Urinary or serum catecholamines
- Plasma renin and aldosterone
- Renal ultrasound
- Doppler ultrasound of aorta and renal vessels
- Echocardiography
- Out of office monitoring
 - 24-hour ambulatory BP monitoring
- Further imaging dependent on suspected underlying cause

Treatment Approach

To be undertaken by non-specialist practitioners (eg, GP Team):

- Therapeutic lifestyle changes
 - Exercise
 - Weight loss
 - Low-salt or no-added-salt diet
 - Increased intake of:
 - Fresh vegetables
 - Fruits
 - Fibre
 - Low-fat dairy products

To be undertaken by specialist practitioners (eg, Emergency Department / Paediatric / Paediatric Nephrology Team(s)):

- Therapeutic lifestyle advice if not already addressed
- Pharmacological therapy
 - Indicated in children and adolescents who:
 - Do not respond to lifestyle modifications
 - Have such conditions as:
 - Stage 2 systemic hypertension
 - Secondary hypertension
 - Established hypertensive target-organ damage
 - Choice of antihypertensive therapy depends on underlying aetiology and concomitant disorders
 - Angiotensin-converting enzyme inhibitors (eg, enalapril, lisinopril) or angiotensin-receptor blockers (eg, irbesartan, losartan)
 - Avoid in confirmed or suspected renal artery stenosis

- Caution in renal disease
- Monitor electrolytes
- β -Blockers (eg, atenolol, propranolol hydrochloride, metoprolol tartrate)
- Calcium-channel blockers (eg, amlodipine, nifedipine)
- Diuretics
 - Useful in volume-dependent hypertension

Figure 1 Age-, sex-, height-, and weight-specific percentiles of systolic and diastolic blood pressure in boys (left) and girls (right) from birth to 12 months of age. Task Force on Blood Pressure Control in Children. Report of the Second Task Force on Blood Pressure Control in Children—1987. Pediatrics. 1987;79(1):1–25

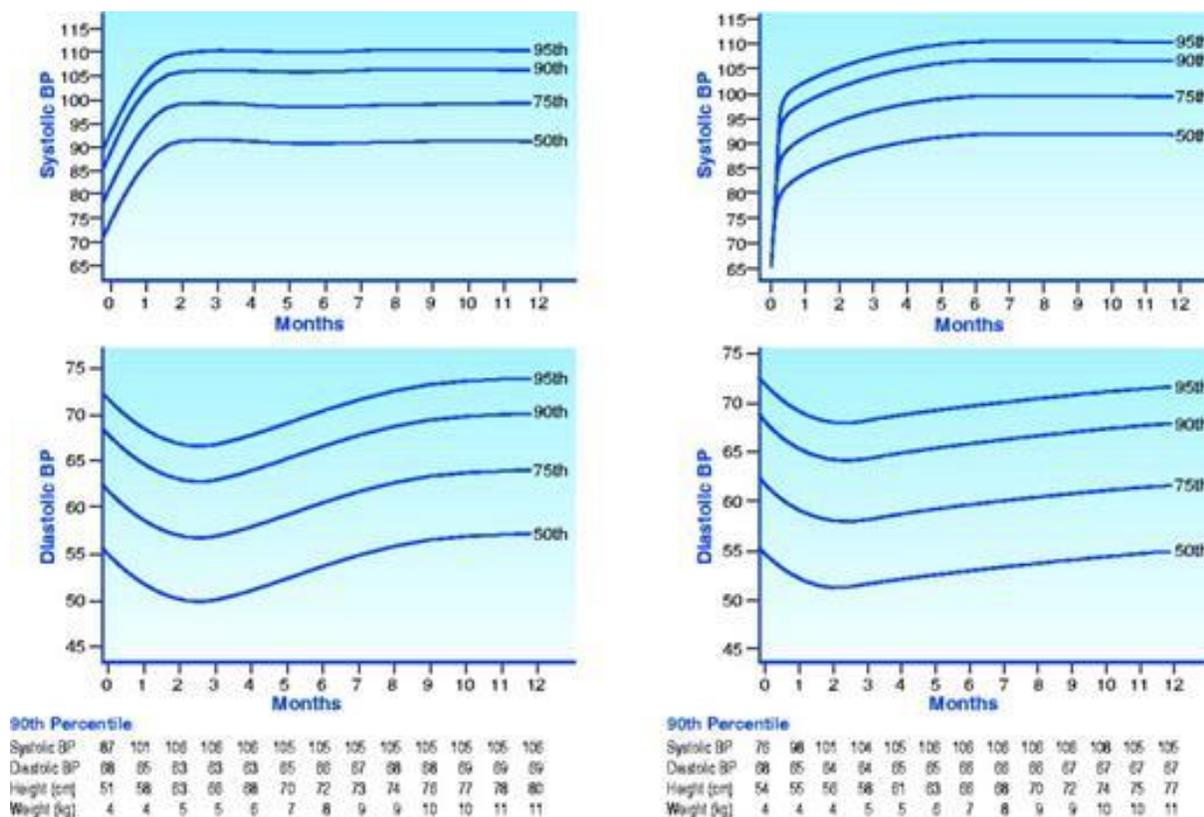
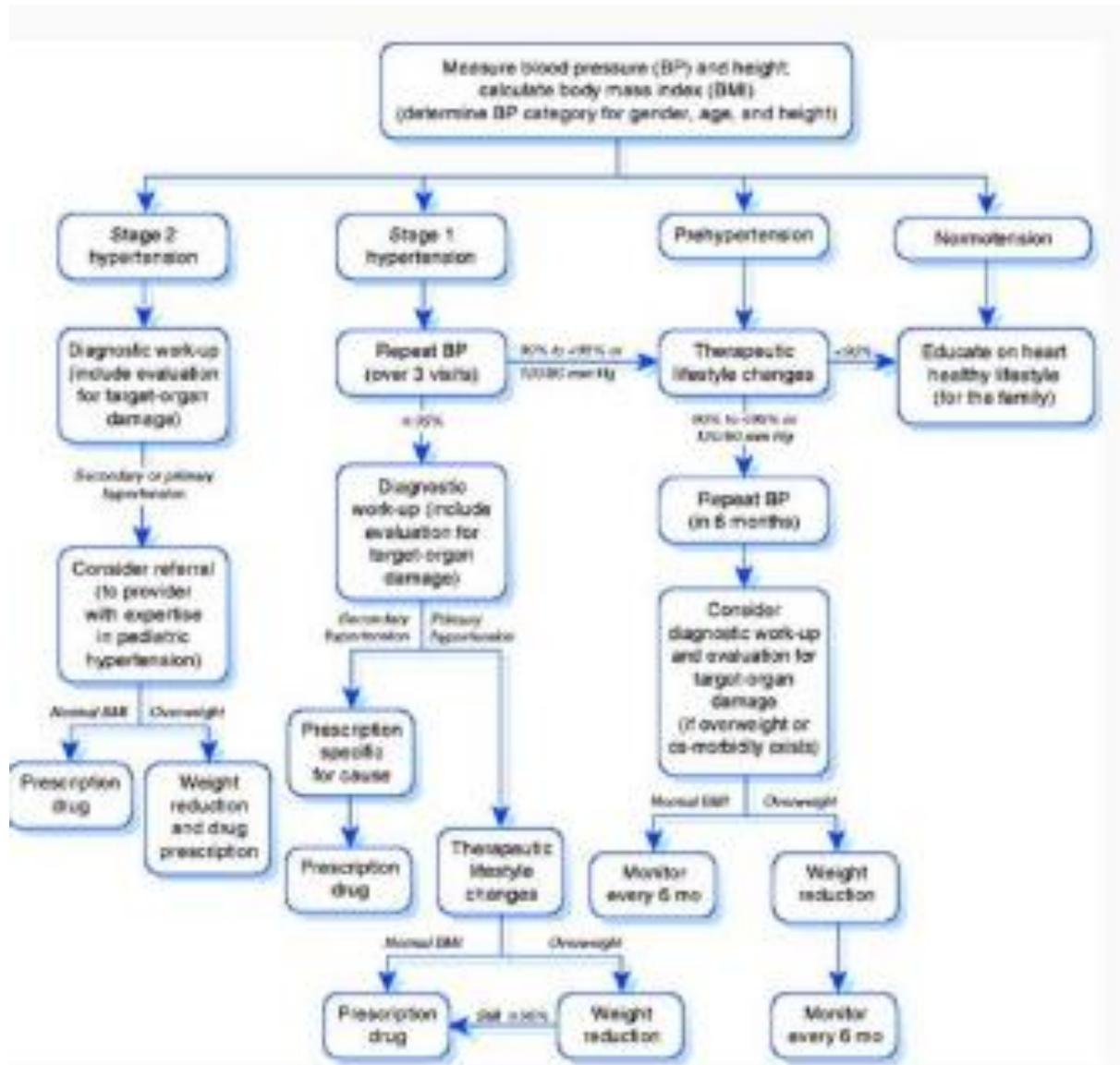


Figure 2: Algorithm for diagnosing high blood pressure in children. Modified from National High Blood Pressure Education Program Working Group on High Blood Pressure in Children and Adolescents. The fourth report on the diagnosis, evaluation, and treatment of high blood pressure in children and adolescents. Pediatrics 2004;114(2):555–57



When to Refer

Refer to specialist practitioners (eg, Emergency Department / Paediatric / Paediatric Nephrology Team(s)) if:

- The patient has stage 1 or 2 hypertension
- The patient has symptomatic hypertension (see Hypertensive Emergencies)

- There is evidence of target-organ damage
 - Left ventricular hypertrophy
 - Renal impairment
 - Retinopathy
- The patient has secondary hypertension

Escalate care to subspecialist team (nephrology, endocrinology or cardiology) if:

- The patient has secondary hypertension due to a condition that requires specialist investigation or management

‘Safety Netting’ Advice

- Stage 1 hypertension
 - Monitor every 3–6 months
- Stage 2 hypertension
 - Monitor more closely, depending on degree of control
- Sports participation by children with hypertension
 - Encourage non-competitive sports and aerobic exercise in all
 - Prehypertension
 - No restriction, can participate in competitive sports
 - Stage 1 hypertension
 - No restriction, can participate in competitive sports if no end-organ damage
 - Stage 2 hypertension
 - Eligible for competitive sports depending on the extent of cardiac disease
 - Encourage aerobic exercises at an intensity determined by the extent of cardiac disease

Patient / Carer Information

****Please note: whilst these resources have been developed to a high standard they may not be specific to children.***

- [Hypertension](#) (Web page), infoKID

Resources

Suggested Resources

****Please note: these resources include links to external websites. These resources may not have national accreditation and therefore PCO UK cannot guarantee the accuracy of the content.***

- [Amlodipine for hypertension](#) (Web page), Medicines for Children

[Enalapril for high blood pressure](#) (Web page), Medicines for Children

[Labetalol hydrochloride for hypertension](#) (Web page), Medicines for Children

[Lisinopril for high blood pressure](#) (Web page), Medicines for Children

[Nifedipine for high blood pressure](#) (Web page), Medicines for Children

[BMI Calculator](#) (Web page), the NHS website

US Department of Health and Human Services. [The Fourth Report on the Diagnosis, Evaluation, and Treatment of High Blood Pressure in Children and Adolescents](#). National Institutes of Health, 2005

Acknowledgments

Content Editor: Dr Eleanor Augustine

Clinical Expert Reviewers: Dr Manish Sinha, Dr Cheentan Singh and Dr Louise Oni

GP Reviewer: Dr Daniel Lang

AAP Reviewer: Jane Meschan Foy, MD, FAAP

Paediatric Trainee Reviewer: Dr Akhila Vasanth Hassan

Paediatric Specialty Group: [British Association for Paediatric Nephrology](#)

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