The hypertensive child

Emma Roffey, Habib Bhurawala

CASE

A boy aged 11 years presented to a rural emergency department with two days of intermittent headaches, abdominal pain, non-bilious vomiting and diarrhoea. He was previously well and had no family history of hypertension. Examination revealed a heart rate of 58 beats per minute, a respiratory rate of 20 breaths per minute, temperature 36.8°C, dry mucus membranes and significantly elevated blood pressure of 160/90 mmHg (>95th centile for age, sex and height).[1] The rest of the physical examination was unremarkable. Full blood examination, liver function tests, urea, electrolytes, creatinine and urinalysis were unremarkable apart from mild haemoconcentration. Electrocardiography showed sinus bradycardia with no left ventricular hypertrophy. Urine culture, stool culture and viral polymerase chain reaction were negative. He was admitted for rehydration and investigation of hypertension.

QUESTION 1

What is the definition of hypertension in children and when should screening occur?

QUESTION 2

What are the causes of hypertension in children?

QUESTION 3

How is hypertension investigated in children?

ANSWER 1

According to the American Academy of Pediatrics' *Clinical Practice Guideline for Screening and Management of High Blood Pressure in Children and Adolescents*,[1] elevated blood pressure (BP) in children and adolescents is defined as systolic BP and/or diastolic BP between the 90th and 95th percentile for sex, age and height.[1] Hypertension is defined as average systolic BP and/or diastolic BP ≥95th percentile over three visits. Hypertension is classified as stage 1 (BP ≥95th percentile) or stage 2 (BP ≥95th percentile + 12 mmHg).[1] BP should be based on the average of three measurements using the correct cuff size: bladder length 80–100% of the circumference of the arm and width 40%. The auscultatory (manual) method should be used to confirm elevated readings on an automatic device.

The prevalence of hypertension in children and adolescents is approximately 3.5%.[1] However, hypertension has been identified in up to 24.8% of overweight children.[1] Hypertension in childhood increases the risk of adulthood hypertension, accelerated vascular ageing and metabolic syndrome.[2] Hypertension is often asymptomatic. Occasionally children present with symptomatic hypertension, with features of end-organ damage.[1] The American Academy of Pediatrics recommends annual BP measurement for children aged >3 years and increased frequency if risk factors are present.[1] BP measurement should be considered for children and adolescents, especially if risk factors for hypertension are present (eg obesity, diabetes, renal disease, coarctation or taking medications associated with hypertension).[1,3]

ANSWER 2

Hypertension can be primary, with no clear cause, or secondary, occurring as a result of another medical condition. Primary hypertension is associated with mild hypertension, older age (≥6 years), family history of hypertension and obesity.[1] Renal disease and renal artery stenosis are the most common secondary causes of hypertension in children, accounting for 34–79% of secondary hypertension.[1] Less common causes of secondary hypertension include coarctation; catecholamine, mineralocorticoid or glucocorticoid excess; hyperthyroidism; hyperparathyroidism; congenital adrenal hyperplasia; environmental exposures; genetic syndromes and medications.[1] In this case, because of the severely elevated BP, pain and secondary causes of hypertension were considered.

ANSWER 3

Thorough history – including perinatal, nutritional, activity, psychosocial and family history – and physical examination are required to identify risk factors and features of secondary hypertension. Examination features of secondary hypertension may include tachycardia, decreased lower extremity pulses, proptosis, moon facies, goiter, striae, cardiac murmur, abdominal mass, growth retardation or pallor.[1] If a child is aged ≥6 years, is overweight, has a family history of hypertension and/or has no history or examination features of secondary hypertension, extensive evaluation for secondary causes is not recommended.[1]

Screening tests include:[1]

- urinalysis and electrolytes, urea, creatinine plus glycated haemoglobin and liver function tests if the patient is obese

- renal ultrasonography if the above tests are abnormal
- additional tests guided by history and examination:
  - full blood examination
  - thyroid stimulating hormone
  - sleep study
  - Doppler renal ultrasonography if not obese and >7 years of age
- echocardiography at the time of consideration of pharmacological treatment.

CASE CONTINUED

The child's vomiting and diarrhoea resolved and he tolerated oral rehydration; however, his BP remained above the 95th percentile. Renal ultrasonography, renal artery Doppler, plasma renin:aldosterone ratio, urine catecholamines, adrenocorticotropic hormone and cortisol were within normal limits. Four-limb BP measurements were not suggestive of coarctation. Investigations for abdominal pain including abdominal radiography and ultrasonography, coeliac serology, *Helicobacter pylori* antibodies, amylase, lipase and inflammatory markers were also within normal limits. After consultation with paediatric nephrology, gastroenterology and endocrinology, stage 2 hypertension secondary to non-specific abdominal pain was diagnosed.

QUESTION 4

How is hypertension treated?

ANSWER 4

Treatment aims to reduce systolic and diastolic BP to below the 90th percentile. Non-pharmacological interventions including Dietary Approaches to Stop Hypertension (DASH) diet and physical activity (30–60 minutes of physical activity 3–5 times per week) are first-line treatment options.[1] Medications are added if the child remains hypertensive despite lifestyle modifications or if they are symptomatic or have renal disease, diabetes or stage 2 hypertension without a modifiable factor.[1] First-line pharmacology treatment comprises low-dose angiotensin-converting enzyme inhibitor, angiotensin II receptor blocker, long-acting calcium channel blocker or thiazide diuretic. Doses should be titrated every 2–4 weeks and a second agent added if BP is not controlled. For children with acute severe hypertension who have life-threatening symptoms, immediate short-acting antihypertensive medications should be used.[1]

CASE CONTINUED

This child was commenced on non-pharmacological analgesia methods, simple analgesia and a proton pump inhibitor. As hypertension persisted, he was commenced on nifedipine 10 mg orally every four hours as required, and antihypertensives were titrated. His BP was well controlled on amlodipine 10 mg twice daily, and the headaches and abdominal pain improved. On discharge a paediatrician reviewed him regularly and encouraged lifestyle modifications including regular physical activity, a balanced diet and avoiding excessive sodium consumption. He remained well with no abdominal pain or headaches. After one month, amlodipine was weaned and ceased and BP remained within target (50th percentile).

Key points

- Hypertension has an overall prevalence of 3.5% in children and adolescents, with higher rates in those who are overweight.
- Childhood hypertension increases the risk of adult hypertension, accelerated vascular ageing and metabolic syndrome.
- Consider assessing blood pressure in children and adolescents, especially if they are obese, taking medications associated with hypertension or have diabetes, coarctation or renal disease.

Authors

Emma Roffey MD, BVSc (Hons), Resident Medical Officer, Nepean Hospital, NSW. Emma.Roffey@health.nsw.gov.au

Habib Bhurawala MBBS, MD, DCH, FRACP, Head of Paediatric Department, Nepean Hospital, NSW; Conjoint Clinical Lecturer, Discipline of Paediatrics, Sydney Medical School-Nepean, University of Sydney, NSW

Competing interests: None.

Funding: None.

Provenance and peer review: Not commissioned, externally peer reviewed.

References

1. 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(3):e20171904. doi: 10.1542/peds.2017-1904.
2. The 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 Aug;114(2 Suppl 4th Report):555–76.
3. Ayer JG, Sholler GF. Cardiovascular risk factors in Australian children: Hypertension and lipid abnormalities. Aust Prescr 2012;35(2):51–55. doi: 10.18773/austprescr.2012.024.

correspondence **ajgp@racgp.org.au**