

Hypertension:

When a Child's Heart Aches

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More on Pat

Pat is referred for hypertension evaluation. His past medical records reveal he was born pre-term at 30 weeks gestation and had a difficult neonatal period requiring umbilical artery catheterization.

Further evaluation on two subsequent visits reveals blood pressure readings between 120 mmHG and 130 mmHG systolic and 80 mmHG and 90 mmHG diastolic.

How would you proceed? For more, go to page 107.

There is a 1% to 3% prevalency of hypertension in the pediatric age group. This may be increasing with higher rates of obesity in children. The prevalence of persistent secondary hypertension in children is about 0.1%; > 80% have underlying kidney disease.

Hypertension may be increasing with higher rates of childhood obesity.

What is normal?

Blood pressure is normal if the average systolic and diastolic readings on repeated measurements are below the 90th percentile for age, gender, and height. Patients between the 90th and 95th percentiles are considered borderline and need to be watched. Significant hypertension exists if either systolic or diastolic averages are > 95th percentile for age,

Table 1

Common causes of hypertension in children

Age group	Causes
Newborns	Artery thrombosis, renal artery stenosis, congenital renal malformation, coarctation of the aorta, bronchopulmonary dysplasia
Infancy-6 years	Renal parenchymal disease, coarctation of the aorta, renal artery stenosis
6-10 years	Essential hypertension (including obesity), renal artery stenosis, renal parenchymal diseases
Adolescence	Essential hypertension (including obesity), renal parenchymal diseases

gender, and height on three separate occasions.

What isn't normal?

"Severe" hypertension means systolic or diastolic values above the 99th percentile. A single measurement is sufficient.

All children and adolescents whose blood pressure is above the 95th percentile should be thoroughly evaluated and treated. Patients whose blood pressure is between the 90th and 95th percentiles should be observed carefully and evaluated if risk factors such as obesity are present; tracking data suggest this subgroup is more likely to develop overt hypertension over time than more normotensive children.¹

Table 2

Diagnostic evaluation of the hypertensive child

Initial Evaluation:

- Full blood count
- Renal function tests
- Lipid profile
- Urinalysis
- Urine culture
- Renal ultrasound

Additional tests as indicated:

- Nuclear scans-DMSA (dimercaptosuccinic acid), Captopril renography-DTPA (diethylene triamine pentaacetic)
- Doppler ultrasound of renal arteries
- Urinary catecholamine
- Echocardiography
- Plasma measurement and urinary steroids
- Renal arteriography (only after urinary catecholamines have excluded pheochromocytoma).

Pat's Prognosis

The lab work-up revealed normal blood urea, serum creatinine and electrolytes.

A renal ultrasound detected a small, contracted left kidney with normal sized right kidney.

The Doppler study revealed evidence of left renal artery stenosis. This was confirmed subsequently on arteriography.

Pat was started on Enalapril and his blood pressure is now controlled. His headaches have disappeared.

What causes hypertension?

Hypertension is primary ("essential") or secondary (resulting from a definable cause). The younger the patient, and the more severe the hypertension, the more likely a secondary cause will be found. Most acute hypertension in childhood is due to glomerulonephritis (see Table 1).

Table 3

Antihypertensive drugs frequently used in children

Drug	Dose Initial	Maximum
Hypertensive emergencies		
Nifedipine	0.25 mg/kg body weight	0.5 mg/kg body weight
Sodium nitroprusside	0.5 g/kg/min IV	8 µg/kg/min IV
Labetalol	1 mg/kg/h IV, (as bolus or steady infusion)	3 mg/kg/h IV
Long-term therapy		
Captopril		
Neonates	0.03 mg/kg/day	2 mg/kg/day
Children	1.5 mg/kg/day	6 mg/kg/day
Enalapril	0.15 mg/kg/day	
Extended-release nifedipine	0.25 mg/kg/day	3 mg/kg/day
Amlodipine	0.1 mg/kg/dose (1-2 times daily)	0.6 mg/kg/day (maximum 20 mg/day)
Propranolol	1 mg/kg/day	8 mg/kg/day
Atenolol	1 mg/kg/day	8 mg/kg/day
Prazosin	0.05-0.1 mg/kg/day	0.5 mg/kg/day
Minoxidil	0.1-0.2 mg/kg/day	1 mg/kg/day
Hydrochlorothiazide	1 mg/kg/day	2-3 mg/kg/day
Furosemide	1 mg/kg/day	12 mg/kg/day
Bumetanide	0.02-0.05 mg/kg/day	0.3 mg/kg/day

IV: intravenous

How should you evaluate?

Evaluation depends on the child's age, severity of hypertension, extent of end-organ damage, and long-term risk factors for the individual patient (Table 2). A thorough personal and family history should include:

- specific questions regarding intrauterine growth rate and neonatal course;
- urinary tract infections;
- significant medical illness/trauma,
- medication use;
- family history of hypertension;
- early cardiovascular or cerebrovascular events; and
- end-stage renal disease.

The physical examination includes:

- evaluation for four extremity pulses,
- blood pressure,
- bruits,
- skin lesions, and
- other standard components.

How should you manage?

The goal is to decrease the short- and long-term risks of cardiovascular diseases and end-organ disease resulting from high blood pressure. Reducing blood pressure alone is insufficient; the issues of obesity, hyperlipidemia, smoking, and glucose intolerance must also be addressed. Home monitoring of blood pressures (after proper training) contributes significantly in the management of hypertension.² See Tables 3 and 4 for non-pharmacologic and pharmacologic management options. CME



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Table 4

Management options

Nonpharmacologic:

- weight reduction,
- exercise, and
- dietary intervention.

Pharmacologic:

- reserved for blood pressure levels above the 99th percentile, or
- presence of end-organ involvement, or
- failure of nonpharmacologic methods

Take-home message



- All children and adolescents whose blood pressures are persistently above the 95th percentile should be evaluated thoroughly and some form of treatment initiated.

References

1. Must A, Jacques PF, Dallal GE, et al: Long-term mortality and morbidity of overweight adolescents: A follow-up of the Harvard Growth Study of 1922 to 1935. *N Engl J Med* 1992; 327(19):1350-5.
2. Cappuccio FP, Kerry SM, Forbes L, et al: Blood pressure control by home monitoring: Meta-analysis of randomised trials. *BMJ* 2004; 329(7458):145.

Further references available—contact *The Canadian Journal of CME* at cme@sta.ca.