The Hypertensive Adolescent

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Increases in the prevalence of childhood hypertension and a growing realization that childhood BP has long-term implications for the development of adult cardiovascular disease have increased the attention paid to hypertension in children and adolescents (1,2). This review will present a clinical case of an adolescent with hypertension followed by discussion of the currently recommended evaluation and management of the patient.

The patient is a 17-year-old adolescent referred by her pediatrician for evaluation of possible hypertension. Referral BP reading was 152/102 mm Hg; cuff size and method were not specified (unsure if repeated). Repeat BP readings in the hypertension clinic were 136/96 mm Hg in the right arm by automated office BP device (using adult cuff), 134/84 mm Hg in the right arm by auscultation (using adult cuff), and 169/98 mm Hg in the right leg by automated device.

According to the 2017 American Academy of Pediatrics Clinical Practice Guideline on childhood hypertension, the patient’s referral BP reading is consistent with stage 2 hypertension, which warrants immediate evaluation (2). Ideally, the BP reading should have been repeated at the same visit, and if the reading had been obtained using an automated device, a repeat BP by auscultation should have been obtained. The repeat BP values in the hypertension clinic are consistent with stage 1 hypertension, and they are lower than the referral BP value, likely representing the patient’s accommodation to having her BP measured repeatedly. A leg BP reading was obtained to assess for possible coarctation of the aorta, which is unlikely given that the leg BP reading is higher than that in the arm.

Because an outcomes-based definition of hypertension has not been established for pediatric patients, childhood hypertension is defined statistically on the basis of the distribution of BP values in healthy children. Using this approach, BP in childhood can be classified as follows (2). Stage 1 hypertension: BP > 95th percentile for age, sex, and height or 120/80 mm Hg for adolescents ≥ 13 years old.

- Normal BP: BP < 90th percentile for age, sex, and height or < 110/80 mm Hg for adolescents ≥ 13 years old.
- Elevated BP: BP reading ≥ 90th percentile and < 95th percentile for age, sex, and height or 120–129/90–89 mm Hg for adolescents ≥ 13 years old.
- Hypertension: BP ≥ 95th percentile for age, sex, and height or ≥ 130/80 mm Hg for adolescents ≥ 13 years old. Hypertensive-level BP is further staged as follows.

- Stage 1 hypertension: BP = 95th–99th percentile for age, sex, and height up to the 95th percentile + 11 mm Hg or 130–139/80–89 mm Hg for adolescents ≥ 13 years of age.
- Stage 2 hypertension: BP ≥ 95th percentile + 12 mm Hg for age, sex, and height or > 140/90 mm Hg for adolescents ≥ 13 years of age.

Adult BP thresholds were applied to adolescents, because the 90th percentile value for 13-year-old boys and girls of average height was approximately 120/80 mm Hg and because this aligns with the updated guidelines for adult hypertension (3).

In the hypertension clinic, the patient denied any symptoms and had no other complaints. However, her mother volunteered that the girl snored and that polysomnography had been ordered by the pediatrician. Birth history was normal, and the only surgical procedure was a tonsillectomy 9 years previously. Family history was remarkable for hypertension and type 2 diabetes. The girl is a junior in high school and does not participate in any regular physical activity outside of gym class 2 d/wk. Physical examination is notable for weight of 83.1 kg (96th percentile) and body mass index of 31.1 kg/m² (96th percentile), and it is otherwise normal.

Evaluation of the pediatric patient with suspected or confirmed hypertension should begin with a thorough history. Symptoms of hypertension are frequently absent, and therefore, it is important to elicit symptoms of potential secondary causes of hypertension. In this patient, snoring may be a symptom of obstructive sleep apnea, which has been associated with hypertension in adults. Birth and family histories should also be included; up to 75% of pediatric patients with primary hypertension have a hypertensive parent or grandparent (4). Perinatal issues, such as maternal eclampsia, prematurity, or small for gestational age status, have been linked to higher BP later in life, including in childhood (5).

This patient has a history of physical inactivity, and her growth parameters classify her as having obesity, which is defined in childhood as body mass index ≥ 95th percentile. There is a strong link between childhood obesity and hypertension, and both excess weight and physical inactivity have been linked to higher childhood BP (6). For this reason, increased physical activity is a cornerstone of management of childhood hypertension.
and it should be recommended regardless of whether the child's hypertension is ultimately felt to require antihypertensive medications (2).

Urinalysis in the hypertension clinic is normal. Laboratory studies obtained by the referring provider are reviewed. The basic metabolic panel (electrolytes, BUN, and creatinine) is normal; nonfasting lipid profile shows elevated LDL cholesterol, elevated triglycerides, and low HDL cholesterol. An ambulatory BP monitor is placed, and the polysomnography results are requested. The patient is scheduled for a return visit in 4 weeks.

All children and adolescents with hypertension should undergo a standard laboratory evaluation primarily to screen for possible secondary causes of hypertension, such as kidney disease, and detect any comorbid conditions, such as dyslipidemia. Because this patient also has obesity, additional laboratory studies are warranted, including liver enzymes to screen for fatty liver and glycosylated hemoglobin to screen for prediabetes. She will need follow-up fasting laboratory tests given the outside results. Consistent with adult guidelines (3), 24-hour ambulatory BP monitoring is now recommended to confirm the diagnosis of hypertension in children and adolescents and assess the patient's BP pattern. Using the combination of office/clinic BP readings and the ambulatory BP, patients can be classified into one of four BP phenotypes: normal BP, white coat hypertension, ambulatory hypertension, or marked hypertension. Normative data and consensus recommendations are available for interpretation of pediatric ambulatory BP studies (7).

Figure 1. | A 24-hour ambulatory BP recording demonstrates ambulatory hypertension. HR, heart rate; PP, pulse pressure.

The patient had ambulatory hypertension (Figure 1), with mean wake BP of 156/101 mm Hg, mean sleep BP of 131/77 mm Hg, and BP loads (percentage of readings greater than threshold) of 81%–100%. Nocturnal BP dipping was normal for both systolic and diastolic BP (16% and 24%, respectively). Polysomnography was normal. Given the severe BP elevation, she was started on lisinopril, and an echocardiogram and kidney ultrasound were obtained. The echocardiogram showed mild concentric left ventricular hypertrophy and normal function; the kidney ultrasound was normal. She met with a dietitian and physical therapist who worked with her to make dietary changes, such as decreasing sodium intake, and increase her level of physical activity.

This patient has a markedly abnormal ambulatory BP study; it not only confirms her hypertension diagnosis, but because the BP loads are all >50%, she would be classified as having severe ambulatory hypertension (7). One could make the case that she also has masked hypertension given that the mean wake BP is higher than her clinic BP readings. Identification of patients with masked hypertension is important, because it has been associated with development of left ventricular hypertrophy and adverse cardiovascular outcomes in both adults and children (8,9).

Consistent with current guidelines (2), she was started on treatment with an antihypertensive medication. Other indications for antihypertensive medication treatment in young patients include symptomatic hypertension, CKD, and diabetes (2). Recommended first-line medications for hypertensive children include all major classes of antihypertensive medications, with the exception of β-blockers. All classes of antihypertensive medications have been studied in children, and many agents have pediatric indications and dosing recommendations (10).
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References

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