Topic: Hypertension (HTN)

Learning Objectives:

At the end of this learning experience, viewers will be able to:

1. Define pre-hypertension, Stage I HTN and Stage II HTN
2. Describe how primary hypertension is diagnosed in childhood
3. List the most common causes of secondary hypertension
4. Describe the initial management and work-up for children with asymptomatic stage I HTN
Case:

JJ is a 17-year-old African-American girl who comes to see you for a WCC. Other than a history of prematurity (born at 35 weeks, no NICU stay), she has no medical problems. Her only medication is oral contraceptives. Her last menstrual period was 1 week ago. Her mother takes antihypertensive medications and her paternal grandfather had a stroke at age 50. On examination, her weight is 87 kg (191 lb, >97th percentile), height 170 cm (67in, 75-90th percentile), BMI 30.1 (>95th percentile). Her blood pressure is 138/88 mm Hg at this visit. The only other significant finding is acne on her face and upper back.

Question 1: What is your next step?
Question 1: What is your next step?

Recheck BP manually ensuring correct cuff size.

To choose the correct cuff size, go to Table 2 of *The Fourth Report on the Diagnosis, Evaluation, and Treatment of High Blood Pressure in Children and Adolescents* (Pediatrics, 2004):  [Choosing the correct cuff size](http://pediatrics.aappublications.org/cgi/reprint/98/4/649.pdf)

1. An appropriate cuff size is a cuff with an inflatable bladder width that is at least 40% of the arm circumference at a point midway between the olecranon and the acromion.

2. The cuff bladder length should be 80-100% of the arm circumference. Such a requirement demands that the bladder width-to-length ratio be at least 1:2.


Question 2: How is elevated BP defined?
Question 2: How is elevated BP defined?

**HTN Definitions.** BP norms are determined by patient’s gender, age and height percentile.

**Normal BP:**
- < 90th percentile for a patient’s gender, age and height percentile
- You can find the BP norm tables at: https://www.nhlbi.nih.gov/health-pro/guidelines/current/hypertension-pediatric-jnc-4/blood-pressure-tables.htm

**Classifying Hypertension**

**View Table 5**, Classification of Hypertension in Children and Adolescents, With Measurement Frequency and Therapy Recommendations: http://pediatrics.aappublications.org/content/114/Supplement_2/555

**Pre-HTN:**
- Systolic and/or diastolic BP between 90 and 95th percentile  
  OR  
- If BP exceeds 120/80 even if <90th percentile up to <95th percentile  
  - If BP >90th percentile, check two more times at same visit and use average

**Stage I HTN:**
- Defined as systolic and/or diastolic BP between the 95th and 99th percentile + 5 mm Hg on three separate occasions.
- How to accomplish BP measurements on 3 separate occasions?  
  - Return to clinic for BP checks  
  - Can give patient a script for ambulatory BP monitoring; School nurse can check and fax results to PCP
- Stage I HTN can be evaluated with a non-urgent and phased approach.

**Stage II HTN:**
- Defined as systolic and/or diastolic BP greater than the 99th percentile + 5 mm Hg.
- Stage II HTN (BP significantly above the 99th percentile) is generally a cause for concern and should be evaluated and treated promptly.
Back to our patient…

JJ’s initial BP was 138/88, >95\textsuperscript{th} percentile for both SBP and DBP. When you rechecked her BP manually, it was 136/86, still >97\textsuperscript{th} percentile for SBP, and at the 95\textsuperscript{th} percentile for DBP.

Question 3: What is your assessment? What do you do now?
**Question 3: What is your assessment? What do you do now?**

JJ’s BP at this office visit meets Stage I HTN criteria. However, a diagnosis of HTN can only be made after elevated BP is confirmed by measurement on three separate occasions.

After speaking with JJ and her parent, you decide to have JJ’s BP checked at school. You send JJ home with a script for the school nurse to check the BP in the same arm weekly for three weeks and to fax the results to you.

| Stage 1 hypertension | 95th–99th percentile plus 5 mm Hg | Recheck in 1–2 wk or sooner if the patient is symptomatic; if persistently elevated on 2 additional occasions, evaluate or refer to source of care within 1 mo | Weight–management counseling if overweight; introduce physical activity and diet management‡ | Initiate therapy based on indications in Table 6 or if compelling indications (as shown above) exist |

From: [http://pediatrics.aappublications.org/content/114/Supplement_2/555](http://pediatrics.aappublications.org/content/114/Supplement_2/555)

Now, one month later, JJ is back for her follow-up visit with you. The school nurse’s BP measurements confirm what you had suspected: JJ has Stage I HTN.

**Question 4: What differentiates primary (essential) from secondary HTN?**
**Question 4: What differentiates primary (essential) from secondary HTN?**

<table>
<thead>
<tr>
<th>Primary (essential) HTN</th>
<th>Secondary HTN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Usually mild or stage I HTN</td>
<td>Usually more severe or stage II HTN</td>
</tr>
<tr>
<td>Usually adolescents and postpubertal children</td>
<td>Usually prepubertal children</td>
</tr>
<tr>
<td>Associated with FH of HTN and/or cardiovascular disease (CVD)</td>
<td>May be associated with clinical signs suggestive of systemic diseases</td>
</tr>
<tr>
<td>Frequently overweight</td>
<td></td>
</tr>
<tr>
<td>Often associated with other risk factors for CVD (insulin resistance, high TG and low HDL cholesterol)</td>
<td></td>
</tr>
</tbody>
</table>

**Note:** The adolescent or young adult who is overweight, has a positive family history of hypertension, and has elevated blood pressure readings on three occasions with a normal physical examination is likely to have **essential (primary) hypertension**.

**Indications of Secondary HTN**

**Question 5:** When should you screen for secondary causes of hypertension? What are causes of secondary hypertension and what tests would you order to look for them?
Question 5: When should you screen for secondary causes of hypertension? What are causes of secondary hypertension and what tests would you order to look for them?

Secondary causes should be sought if:
- the child is “young” (i.e., not an adolescent)
- the HTN is severe (stage II) or symptomatic or
- signs and symptoms suggest a specific underlying cause

Evidence of end-organ damage ought to prompt a more thorough evaluation as well. Careful fundoscopic examination is important.

<p>| Causes of Secondary Hypertension: Signs/symptoms and Recommended Testing |
|-----------------------------|-----------------------------|-----------------------------|
| <strong>Condition</strong>               | <strong>Signs/symptoms</strong>          | <strong>Testing</strong>                 |
| Sleep apnea                 | Obesity, snoring, fatigue   | Polysomnography             |
| Substance abuse – cocaine, amphetamines | Tachycardia, behavioral or school problems | Urine toxicology |
| Coarctation of the aorta    | Diminished femoral pulses, cardiac murmur, rib-notching on CXR | 4 extremity BP followed by cardiac echo |
| Renovascular disease – fibromuscular dysplasia | Young children (0-10) with stage I HTN, any child with stage II HTN or HTN refractory to treatment | MRA, US with Doppler, 3-D CT, Isotopic scintigraphy, arteriography |
| Cushing’s syndrome          | Obesity, growth retardation, “buffalo hump,” purple striae | Plasma and urine cortisol, plasma ACTH, dexamethasone suppression test |
| White-coat HTN              | BP elevated in office only, but normal readings in other settings | Ambulatory BP monitoring |
| Hyperthyroidism             | Tachycardia, tremor, weight loss, growth acceleration, delayed puberty, behavioral or school problems | TSH, Free T4 |
| Hyperparathyroidism         | “(urinary) Stones, bones (osteopenia), abdominal groans (nausea, constipation)” Also polyuria, polydipsia | Serum Calcium, serum PTH confirmatory |
| Aldosteronism               | Hypokalemia, hypernatremia  | Low plasma renin and elevated aldosterone |</p>
<table>
<thead>
<tr>
<th>Congenital Adrenal Hyperplasia</th>
<th>Hirsuitism, PCOS, acne</th>
<th>Elevated 17-OH progesterone,</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flushing, tachycardia, paroxysmal HTN (less than 0.2% of hypertensive patients have pheo)</td>
<td>Urine catecholamines (vanillylmandelic acid and metanephrines), serum metanephrines and normetanephrines confirmatory</td>
<td></td>
</tr>
</tbody>
</table>

Clinical Evaluation:

- **View Table 7**, Clinical Evaluation of Confirmed Hypertension for studies and procedures: [http://pediatrics.aappublications.org/content/114/Supplement_2/555](http://pediatrics.aappublications.org/content/114/Supplement_2/555)

**Question 6**: What is the most likely cause of JJ’s hypertension?
Question 6: What is the most likely cause of JJ’s hypertension?

A useful mnemonic for the initial evaluation of a hypertensive child is MONSTER.

You can also view the PowerPoint slide (Figure 3) by Feld L G , and Corey H Pediatrics in Review 2007;28:283-298 in place of the list below. http://pedsinreview.aappublications.org/content/28/8/283.full

M: Medications
- Stimulants (for ADHD, etc)
- Steroids (prescribed and otherwise)
- Oral contraceptives
- Caffeine
- Cocaine
- Excessive ingestion of licorice (!)

O: Obesity/Obstructive Sleep Apnea (OSA)
- Obese children are 3-5 times more likely to have HTN (usually diastolic) than non-obese kids.
- Degree of HTN correlates with BMI and severity of OSA
- Hypothesized mechanism is sympathetic nervous system stimulation, hypoxemia and possibly changes in cardiac output caused by intrathoracic pressure changes

N: Neonatal History
- Umbilical artery catheter
- Asphyxia
- Bronchopulmonary dysplasia
- Renal vein thrombosis
- Maternal substance abuse
- Renal disease – obstructive uropathy, ATN

S: Signs and/or Symptoms
- Constitutional – weight loss, gain, excessive sweating, muscle cramps
- Neurological – headaches, dizziness, visual changes, epistaxis
- GI/GU – pain, dysuria, masses, constipation
- Musculoskeletal – Joint pains and/or swelling, edema
- Skin – acne, butterfly rash, café-au-lait spots, hirsutism, striae
- Cardiac – differential pulses or BPs, murmurs

T: Trends in the Family
- HTN – essential or secondary
- Hyperlipidemia
- Early complications of HTN/cardiovascular disease
- Diabetes
- Renal disease
- Systemic diseases – SLE, Neurofibromatosis
- Tumors

**ER: Endocrine or Renal**

<table>
<thead>
<tr>
<th>Endocrine</th>
<th>Renal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acne</td>
<td>Growth retardation</td>
</tr>
<tr>
<td>Ambiguous genitalia</td>
<td>FH of polycystic kidney disease</td>
</tr>
<tr>
<td>Hirsutism</td>
<td>Palpable mass</td>
</tr>
<tr>
<td>Moon facies</td>
<td>Renal scars</td>
</tr>
<tr>
<td>Shield chest</td>
<td>Trauma</td>
</tr>
<tr>
<td>Striae</td>
<td></td>
</tr>
<tr>
<td>Webbed neck, widely spaced nipples</td>
<td></td>
</tr>
</tbody>
</table>

**Question 7:** Using the note from JJ’s initial visit (below) and the MONSTER mnemonic, identify possible risk factors for HTN in your patient.
Question 7: Using the note from JJ’s initial visit (below) and the MONSTER mnemonic, identify possible risk factors for HTN in your patient.

Remember JJ is a 17-year-old African-American female here for a WCC. Other than prematurity (born at 35 weeks, no NICU care), she has no medical problems. Her only medication is oral contraceptives. Her last menstrual period was one week ago. Her mother takes antihypertensive medications and her paternal grandfather had a stroke at age 50. On examination, her weight is 87 kg (191 lb, >97th percentile), height 170 cm (67in, 75-90th percentile), BMI 30.1 (>95th percentile). Her blood pressure is 138/88 mm Hg at this visit. The only other significant finding is acne on her face and upper back.

M: Medications?
- OCPs: Would you expect this degree of BP elevation solely from use of OCP?
  - While the OCP may be contributing to her BP, it is unlikely that it is the sole cause given her BMI and family history
  - It is unlikely that simply stopping her OCP will resolve her BP problems
  - If possible, alternate forms of birth control should be considered as part of her “lifestyle modification”

O: Obesity/OSA? (Overweight: BMI 85-95th percentile; Obesity: BMI ≥95th percentile)
- Obesity, as BMI >95th percentile
- No signs of OSA

N: Neonatal?
- Born at 35 weeks, but no NICU stay.

S: Signs/symptoms?
- Acne; Any other signs of systemic conditions, including hirsutism, striae?
  - None present, so this most likely represents normal adolescent acne.

T: Trends in the family?
- Mother on anti-hypertensive meds, PGF with stroke at age 50.

ER: Endocrine or Renal?
- Acne, as discussed above
HTN Evaluation:

Question 8: What, if any, studies would you recommend at this time? Explain the reason behind your choice of tests. Is it to rule out secondary causes of HTN, to look for end-organ damage, or to screen for cardiovascular risk factors? Do these evaluations need to be done urgently?
Question 8: What, if any, studies would you recommend at this time? Explain the reason behind your choice of tests. Is it to rule out secondary causes of HTN, to look for end-organ damage, or to screen for cardiovascular risk factors? Do these evaluations need to be done urgently?

According to the 4th Report on the Diagnosis, Evaluation, and Treatment of High Blood Pressure in Children and Adolescents (Pediatrics, 2004), the following studies are required for all children with BP persistently greater than the 95th percentile.

For a patient with asymptomatic Stage I HTN, evaluation can be done in a non-urgent manner.

<table>
<thead>
<tr>
<th>Test</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>BUN, Creatinine, Electrolytes</td>
<td>Screen for renal parenchymal disease</td>
</tr>
<tr>
<td>U/A and culture</td>
<td>Screen for chronic pyelonephritis, nephritis</td>
</tr>
<tr>
<td>CBC</td>
<td>Screen for anemia of chronic renal disease</td>
</tr>
<tr>
<td>Lipid profile and fasting plasma glucose</td>
<td>Screen for cardiovascular risk and diabetes</td>
</tr>
<tr>
<td>Renal Ultrasound</td>
<td>Screen for reflux nephropathy, scarring, congenital anomalies, disparate renal size</td>
</tr>
<tr>
<td>Echocardiogram</td>
<td>Screen for LVH and other indications of cardiac involvement</td>
</tr>
<tr>
<td>Retinal exam</td>
<td>Identify retinal vascular changes</td>
</tr>
</tbody>
</table>

JJ is now back in your office six weeks after her last visit. She has completed her screening evaluations and everything has come back normal. Her BP today is still 136/88, which is 97th percentile.

Question 9: What is your assessment of the etiology of JJ’s HTN?
Question 9: What is your assessment of the etiology of JJ’s HTN?

An obese adolescent who has a negative medical history, normal laboratory screening results, a negative ultrasound, echo and retinal exam, and a positive family history can be given the likely diagnosis of essential hypertension.

Question 10: How do you plan to manage this adolescent with essential stage I HTN?
Question 10: How do you plan to manage this adolescent with essential stage I HTN?

For JJ, results of serial blood pressure measurements indicate a need for intervention according to the Task Force guidelines. **Simply continuing to repeat the blood pressure measurement is inappropriate.**

Question 11: What is your initial choice of therapy? What lifestyle modifications would you recommend? For how long should lifestyle modification be attempted?
Question 11: What is your initial choice of therapy? What lifestyle modifications would you recommend? For how long should lifestyle modification be attempted?

1. Follow-up blood pressure measurements every 1 to 2 months with weight measurements to document the desired weight loss and monitoring of the exercise program would be appropriate.

2. In the setting of asymptomatic Stage I HTN, at least 3-6 months of attempting lifestyle modifications are required to assess impact on BP. Lifestyle modifications include: Source: http://pediatrics.aappublications.org/content/114/Supplement_2/555.full

- Weight reduction is the primary therapy for obesity-related hypertension. Prevention of excess or abnormal weight gain will limit future increases in BP.

- Regular physical activity and restriction of sedentary activity will improve efforts at weight management and may prevent an excess increase in BP over time. Regular aerobic physical activity (30–60 minutes of moderate physical activity on most days) and limitation of sedentary activities to <2 hours per day are recommended for the prevention of obesity, hypertension, and other cardiovascular risk factors.94

- Dietary modification should be strongly encouraged in children and adolescents who have BP levels in the prehypertensive range as well as those with hypertension.

- Family-based intervention improves success.

- Follow the 5-2-1-0 daily recommendations:

  5 servings of fruits and vegetables per day
  2 Hours or less of screen time per day
  1 Hours or more of physical activity per day
  0 Sugar sweetened beverages per day

Question 12: What is the recommended management for an adolescent with prehypertension?
Question 12: What is the recommended management for an adolescent with prehypertension?

- Recommend lifestyle modification and follow up in 6 months with blood pressure recheck.

- Close monitoring is critical as prehypertension progresses to hypertension at a rate of approximately 7% per year.

Question 13: JJ’s mother notes that volleyball season is coming up. She wonders if JJ should sit this season out because of her high blood pressure. What do you tell her?
Question 13: JJ’s mother notes that volleyball season is coming up. She wonders if JJ should sit this season out because of her high blood pressure. What do you tell her?

According to the AAP 2010 policy statement:

- The presence of prehypertension should NOT limit a person’s eligibility for competitive athletics. Patients with prehypertension should have their blood pressures measured every 6 months.

- Stage 1 hypertension in the absence of end organ damage, including LVH, should not limit a person’s ability for competitive athletics. Blood pressure should be rechecked in 1-2 weeks to confirm the hypertension. Referral to a subspecialist should be made if there is evidence of end organ damage, or if blood pressure is persistently elevated.

- Youths with stage 2 hypertension in the absence of end organ damage should be restricted from high static sports (class IIIA to IIIC in figure in link below) until their blood pressure is in the normal range.

Note: In static exercise, muscles are exerted without joint movement (e.g., bodybuilding, cycling, rowing, waterskiing). The primary concern with static exercise is that it causes an acute rise in diastolic blood pressure. In contrast, dynamic exercise, in which muscles are exerted through joint movement (e.g., tennis, running, swimming), is recommended.

See Figure 1. Page 1292. Classification of sports according to cardiovascular demands (based on combined static and dynamic components). From 2010 AAP policy statement. (scroll to page 6 of the pdf) [http://pediatrics.aappublications.org/content/125/6/1287.full.pdf+html](http://pediatrics.aappublications.org/content/125/6/1287.full.pdf+html)

Case (continued)

You recommend diet, exercise, and sodium restriction for 6 months. You also reassure JJ and her mother that participation in volleyball will be a great addition to the other lifestyle modifications she will be making.

Six months later, JJ is back for her follow-up. She has had periodic BP checks at school, which the school nurse has been faxing to you. Today, unfortunately, her BP is still greater than the 99th percentile.

Question 14: Even though you have referred JJ to Weight Management for further care of her HTN, you are a stellar pediatrician and want to check out what the next steps in her treatment would be. What are the indications for initiating anti-hypertensive medication for children and adolescents with HTN?
Question 14: Even though you have referred JJ to Weight Management for further care of her HTN, you are a stellar pediatrician and want to check out what the next steps in her treatment would be. What are the indications for initiating anti-hypertensive medication for children and adolescents with HTN?

According to the 4th Report on the Diagnosis, Evaluation, and Treatment of High Blood Pressure in Children and Adolescents, the following are indications for antihypertensive medication:

- Symptomatic hypertension (headache, nose bleeding, visual changes, encephalopathy)
- Secondary hypertension
- Hypertension with target organ damage (retinopathy, nephropathy, LVH, encephalopathy)
- Patients with type I and II diabetes
- Persistent hypertension despite nonpharmacologic measures (especially if normal BMI).

Question 15: Which medication should be used to treat her blood pressure at this time? What is the goal of drug therapy?
Question 15: Which medication should be used to treat her blood pressure at this time? What is the goal of drug therapy?

**HTN Medication**

Acceptable drug classes for children with HTN include: ACE inhibitors, angiotensin-receptor blockers, beta-blockers, calcium channel blockers, and diuretics. See the table below for a simplified version of Table 9 from the 4th Report.

- The goal of antihypertensive treatment in children should be reduction of BP to less than the 95th percentile.
- The use of angiotensin-converting enzyme inhibitors (ACEIs), angiotensin receptor blockers (ARBs), and calcium channel blockers (CCBs) as first-line therapy. [http://pedsinreview.aappublications.org/content/28/8/283.full.pdf+html](http://pedsinreview.aappublications.org/content/28/8/283.full.pdf+html)
- If HTN is severe or symptomatic, IV medications should be implemented.

<table>
<thead>
<tr>
<th>Class</th>
<th>Drug</th>
<th>Initial Dose</th>
<th>Max Dose</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>First-line Therapy</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calcium Channel Blocker</td>
<td>Amlodipine</td>
<td>2.5-5 mg/day</td>
<td>10 mg/day</td>
<td>– May cause tachycardia and edema</td>
</tr>
<tr>
<td>ACE Inhibitor</td>
<td>Lisinopril</td>
<td>0.07 mg/kg up to 5 mg/day</td>
<td>0.6 mg/kg up to 40 mg/day</td>
<td>– Contraindicated in pregnancy – Check K and Cr periodically – Cough and angioedema potential side effects – Excellent choice for diabetics due to renal protective effects – FDA approved for age ≥6 yrs</td>
</tr>
<tr>
<td>Angiotensin-receptor blocker</td>
<td>Losartan</td>
<td>0.7 mg/kg up to 50 mg/day</td>
<td>1.4 mg/kg up to 100 mg/day</td>
<td>– Contraindicated in pregnancy – Check K and Cr periodically – FDA approved for age ≥6 yrs – Can be turned into a suspension</td>
</tr>
<tr>
<td><strong>Second-line Therapy</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beta Blocker</td>
<td>Atenolol</td>
<td>0.5-1 mg/kg</td>
<td>2mg/kg up to 100 mg/day</td>
<td>– Heart rate is dose limiting – May decrease athletic performance in athletes – Noncardioselective are contraindicated in asthma and heart failure – Avoid in insulin dependent diabetes (blunts symptoms of hypoglycemia)</td>
</tr>
<tr>
<td>Diuretic</td>
<td>HCTZ</td>
<td>1 mg/kg/day or 12.5 to 25 mg HCTZ</td>
<td>3 mg/kg/day up to 50 mg/day HCTZ</td>
<td>– Monitor electrolytes – May combine with triamterene (Dyazide) to spare potassium wasting – Useful adjunct to other medications</td>
</tr>
</tbody>
</table>
Question 16: How well do pediatricians diagnose and manage hypertension?

Simplified version of Table 9 from:
Question 16: How well do pediatricians diagnose and manage hypertension?

From the January 19, 2017 AAP News:

“Among U.S. children meeting clinical criteria for hypertension, few are given a diagnosis of hypertension and even fewer are being treated with medication. These findings are detailed in a recently published study involving the AAP Pediatric Research in Office Settings (PROS) network (Kaelber DC, et al. Pediatrics. 2016).

Data came from analyses of EHRs from 398,079 children ages 3-18 years who had three or more primary care visits between 1999 and 2014 where both blood pressure and height were measured.

- Over 12,000 (3%) of these children met criteria for hypertension as defined by the National Heart, Lung, and Blood Institute (NHLBI).
- 45% were normal weight, 17% were overweight and 38% were obese.

Results showed that of 12,138 children who met NHLBI criteria for hypertension with measures of blood pressure higher than the 95th percentile at three or more separate clinic visits, only 23% (2,813) had a diagnosis of hypertension.

Among the 2,813 children who did have a diagnosis of hypertension, less than 6% (158) were prescribed antihypertensive medication within 12 months of diagnosis. (See figure.)

The study also measured the percentage of children who met NHLBI criteria for pre-hypertension and whether those children had a diagnosis of pre-hypertension.
Results showed that of the 398,079 children who had at least three blood pressure measurements, \textbf{9.8\% met the criteria for pre-hypertension but only 10\% of those with pre-hypertension received a diagnosis.}
Take Home Points:

1. Untreated HTN in children can lead to significant morbidity in adulthood. As pediatricians, it is our responsibility to help our patients reduce their lifetime cardiovascular risk.

2. Look at the BP at every health supervision visit! Determine BP percentiles based on patient age, gender, and height. If BP is elevated, obtain 2 additional, separate measurements within 1 month.

3. A patient with confirmed Stage I HTN needs to be evaluated non-urgently (but promptly) with screening labs, imaging studies, and fundoscopic exam.

4. An obese adolescent who has a negative medical history, normal laboratory screening results, a negative ultrasound, echo and retinal exam, and a positive family history can be given the diagnosis of essential hypertension.

5. Secondary causes of HTN should be sought if the child is “young” (i.e., not an adolescent), if the HTN is severe (stage II) or symptomatic, or if signs and symptoms suggest a specific underlying cause.

6. The first line of management of HTN is weight reduction, dietary modification, and regular physical activity.

7. Indications for antihypertensive medication include symptomatic HTN, secondary HTN, HTN with target organ damage, patients with type I and II diabetes, and persistent hypertension despite nonpharmacologic measures (especially if normal BMI).
Resources:
Information for parents on high blood pressure in children (available in English and Spanish) https://www.healthychildren.org/English/health-issues/conditions/heart/Pages/High-Blood-Pressure-in-Children.aspx
References:


American Heart Association Scientific Statement. Obesity and overweight in children. Pathophysiology, Consequences, Prevention, and Treatment. Available at: http://circ.ahajournals.org/cgi/content/full/111/15/1999?ck=nck


http://www.aappublications.org/news/2017/01/19/Research011917