

Pediatric Hypertension: A Discussion of the 2017 AAP Guidelines

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Objectives

- Become familiar with the 2017 AAP Clinical Practice Guideline for Screening and Management of High Blood Pressure in Children
- Formulate a plan of action when a patient presents to the office with elevated blood pressure

Disclosures

- I am employed by MCAM
- I have had no relevant financial relationships with the manufacturer(s) of any commercial product(s) and/or provider(s) of commercial services discussed in this presentation.
- I do not intend to discuss an unapproved/investigative use of a commercial product/device in my presentation.

Abbreviations

- HTN – Hypertension
- BP – Blood Pressure
- SBP – Systolic Blood Pressure
- DBP – Diastolic Blood Pressure
- BMI – Body Mass Index
- ABPM – Ambulatory Blood Pressure Monitoring
- WCH – White Coat Hypertension (only apparent in the office)
- MH – Masked Hypertension (only apparent outside the office)
- DM – Diabetes Mellitus
- MA – Microalbuminuria
- CKD – Chronic Kidney Disease
- ACC – American College of Cardiology
- AHA – American Heart Association
- AAP – American Academy of Pediatrics
- *Guide* – Clinical Practice Guideline for Screening and Management of High Blood Pressure in Children and Adolescents
- Quick Screen - Table 6 in the *Guide*: Screening BP Values Requiring Further Evaluation. P 15.
- KAS – Key Action Statement in the *Guide*

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- **Quick Screen - Table 6 in the *Guide*: Screening BP Values Requiring Further Evaluation. P 15.**
- **KAS – Key Action Statement in the *Guide***

Guideline Rationale

- Prior pediatric HTN guidelines were issued by the National Heart, Lung, and Blood Institute (NHLBI) in 1977, 1987, 1996, and 2004.
 - In 2013, NHLBI ceased sponsorship of cardiovascular guidelines
- Increased interest in pediatric HTN was generated since the last report
 - 10-11% of children have elevated BP
 - 3.5% of children have hypertension
 - Established link between elevated BP in childhood and hypertension in adults
 - Evidence of accelerated vascular aging in youth with HTN

Changes from NHLBI 4th report

- Revised definitions of BP categories
 - Streamlined to align with AHA/ACC adult guideline
- BP tables based on data from normal-weight children
- Office-friendly BP screening table
- Emphasis on 24-hr ABPM to confirm HTN and follow certain patients
- Lower treatment goals for HTN

Pediatric BP Categories and Stages (1-18 y/o)

- Defined according to distribution of BP in healthy children by age, gender, and height
 - There is not actionable outcome data on cardiovascular endpoints in children and adolescents – thus population-based norms are used
- Changes in HTN categories:
 - Elevated BP (previously pre-hypertension): $\geq 90^{\text{th}}$ %ile to $<95^{\text{th}}$ %ile or 120/80
 - Stage 2 HTN is 95^{th} %ile + 12mmHg or 140/90
 - Cut-points for children ≥ 13 y/o same as AHA/ACC guideline

TABLE 3 Updated Definitions of BP Categories and Stages

For Children Aged 1–<13 y	For Children Aged ≥13 y
Normal BP: <90th percentile	Normal BP: <120/<80 mm Hg
Elevated BP: ≥90th percentile to <95th percentile or 120/80 mm Hg to <95th percentile (whichever is lower)	Elevated BP: 120/<80 to 129/<80 mm Hg
Stage 1 HTN: ≥95th percentile to <95th percentile + 12 mmHg, or 130/80 to 139/89 mm Hg (whichever is lower)	Stage 1 HTN: 130/80 to 139/89 mm Hg
Stage 2 HTN: ≥95th percentile + 12 mm Hg, or ≥140/90 mm Hg (whichever is lower)	Stage 2 HTN: ≥140/90 mm Hg



Notes on the New Tables

- NHLBI 4th Report BP tables – based on ~70,000 healthy children, some of whom were overweight or obese
- AAP 2017 tables based on same data set, excluding children with overweight/obesity (~50,000 included)
- Include inch and centimeter references for height %iles
- Include absolute cut-off values for HTN stages

TABLE 4 BP Levels for Boys by Age and Height Percentile

Age (y)	BP Percentile	SBP (mm Hg)							DBP (mm Hg)						
		Height Percentile or Measured Height							Height Percentile or Measured Height						
		5%	10%	25%	50%	75%	90%	95%	5%	10%	25%	50%	75%	90%	95%
1	Height (in)	30.4	30.8	31.6	32.4	33.3	34.1	34.6	30.4	30.8	31.6	32.4	33.3	34.1	34.6
	Height (cm)	77.2	78.3	80.2	82.4	84.6	86.7	87.9	77.2	78.3	80.2	82.4	84.6	86.7	87.9
	50th	85	85	86	86	87	88	88	40	40	40	41	41	42	42
	90th	98	99	99	100	100	101	101	52	52	53	53	54	54	54
	95th	102	102	103	103	104	105	105	54	54	55	55	56	57	57
	95th + 12 mm Hg	114	114	115	115	116	117	117	66	66	67	67	68	69	69
2	Height (in)	33.9	34.4	35.3	36.3	37.3	38.2	38.8	33.9	34.4	35.3	36.3	37.3	38.2	38.8
	Height (cm)	86.1	87.4	89.6	92.1	94.7	97.1	98.5	86.1	87.4	89.6	92.1	94.7	97.1	98.5
	50th	87	87	88	89	89	90	91	43	43	44	44	45	46	46
	90th	100	100	101	102	103	103	104	55	55	56	56	57	58	58
	95th	104	105	105	106	107	107	108	57	58	58	59	60	61	61
	95th + 12 mm Hg	116	117	117	118	119	119	120	69	70	70	71	72	73	73
3	Height (in)	36.4	37	37.9	39	40.1	41.1	41.7	36.4	37	37.9	39	40.1	41.1	41.7
	Height (cm)	92.5	93.9	96.3	99	101.8	104.3	105.8	92.5	93.9	96.3	99	101.8	104.3	105.8
	50th	88	89	89	90	91	92	92	45	46	46	47	48	49	49
	90th	101	102	102	103	104	105	105	58	58	59	59	60	61	61
	95th	106	106	107	107	108	109	109	60	61	61	62	63	64	64
	95th + 12 mm Hg	118	118	119	119	120	121	121	72	73	73	74	75	76	76
4	Height (in)	38.8	39.4	40.5	41.7	42.9	43.9	44.5	38.8	39.4	40.5	41.7	42.9	43.9	44.5
	Height (cm)	98.5	100.2	102.9	105.9	108.9	111.5	113.2	98.5	100.2	102.9	105.9	108.9	111.5	113.2
	50th	90	90	91	92	93	94	94	48	49	49	50	51	52	52
	90th	102	103	104	105	105	106	107	60	61	62	62	63	64	64
	95th	107	107	108	108	109	110	110	63	64	65	66	67	67	68
	95th + 12 mm Hg	119	119	120	120	121	122	122	75	76	77	78	79	79	80
5	Height (in)	41.1	41.8	43.0	44.3	45.5	46.7	47.4	41.1	41.8	43.0	44.3	45.5	46.7	47.4
	Height (cm)	104.4	106.2	109.1	112.4	115.7	118.6	120.3	104.4	106.2	109.1	112.4	115.7	118.6	120.3
	50th	91	92	93	94	95	96	96	51	51	52	53	54	55	55
	90th	103	104	105	106	107	108	108	63	64	65	65	66	67	67
	95th	107	108	109	109	110	111	112	66	67	68	69	70	70	71
	95th + 12 mm Hg	119	120	121	121	122	123	124	78	79	80	81	82	82	83
6	Height (in)	43.4	44.2	45.4	46.8	48.2	49.4	50.2	43.4	44.2	45.4	46.8	48.2	49.4	50.2
	Height (cm)	110.3	112.2	115.3	118.9	122.4	125.6	127.5	110.3	112.2	115.3	118.9	122.4	125.6	127.5
	50th	93	93	94	95	96	97	98	54	54	55	56	57	57	58
	90th	105	105	106	107	109	110	110	66	66	67	68	68	69	69
	95th	108	109	110	111	112	113	114	69	70	70	71	72	72	73
	95th + 12 mm Hg	120	121	122	123	124	125	126	81	82	82	83	84	84	85
7	Height (in)	45.7	46.5	47.8	49.3	50.8	52.1	52.9	45.7	46.5	47.8	49.3	50.8	52.1	52.9
	Height (cm)	116.1	118	121.4	125.1	128.9	132.4	134.5	116.1	118	121.4	125.1	128.9	132.4	134.5
	50th	94	94	95	97	98	98	99	56	56	57	58	58	59	59
	90th	106	107	108	109	110	111	111	68	68	69	70	70	71	71
	95th	110	110	111	112	114	115	116	71	71	72	73	73	74	74
	95th + 12 mm Hg	122	122	123	124	126	127	128	83	83	84	85	85	86	86



Quick Screen

- Easy to read
- Based on 90th percentile values for children at 5th height %ile

TABLE 6 Screening BP Values Requiring Further Evaluation

Age, y	BP, mm Hg			
	Boys		Girls	
	Systolic	DBP	Systolic	DBP
1	98	52	98	54
2	100	55	101	58
3	101	58	102	60
4	102	60	103	62
5	103	63	104	64
6	105	66	105	67
7	106	68	106	68
8	107	69	107	69
9	107	70	108	71
10	108	72	109	72
11	110	74	111	74
12	113	75	114	75
≥13	120	80	120	80

Correct BP measurement

TABLE 7 Best BP Measurement Practices

1. The child should be seated in a quiet room for 3–5 min before measurement, with the back supported and feet uncrossed on the floor.
2. BP should be measured in the right arm for consistency, for comparison with standard tables, and to avoid a falsely low reading from the left arm in the case of coarctation of the aorta. The arm should be at heart level,⁹⁰ supported, and uncovered above the cuff. The patient and observer should not speak while the measurement is being taken.
3. The correct cuff size should be used. The bladder length should be 80%–100% of the circumference of the arm, and the width should be at least 40%.
4. For an auscultatory BP, the bell of the stethoscope should be placed over the brachial artery in the antecubital fossa, and the lower end of the cuff should be 2–3 cm above the antecubital fossa. The cuff should be inflated to 20–30 mm Hg above the point at which the radial pulse disappears. Overinflation should be avoided. The cuff should be deflated at a rate of 2–3 mm Hg per second. The first (phase I Korotkoff) and last (phase V Korotkoff) audible sounds should be taken as SBP and DBP. If the Korotkoff sounds are heard to 0 mm Hg, the point at which the sound is muffled (phase IV Korotkoff) should be taken as the DBP, or the measurement repeated with less pressure applied over the brachial artery. The measurement should be read to the nearest 2 mm Hg.
5. To measure BP in the legs, the patient should be in the prone position, if possible. An appropriately sized cuff should be placed midthigh and the stethoscope placed over the popliteal artery. The SBP in the legs is usually 10%–20% higher than the brachial artery pressure.

Correct BP measurement

- Initial BP measurement may be oscillometric (machine is calibrated and validated for pediatric use) or auscultatory
 - Validation status can be checked at www.dableducational.org
- Keys
 - Proper cuff size, erring on the side of larger
 - Quiet room, no talking (ideally resting for 3-5 minutes)
 - Back supported, arm supported at heart level, legs uncrossed

When and How Often?

- BP management strategies should begin early
 - Recommendation remains to begin universal screening at 3y/o
- Annual screening if no risk factors
- Every health encounter if risk factors
 - Obesity (BMI>95%ile)
 - Medications that increase BP (including stimulants)
 - Renal disease
 - h/o aortic arch obstruction or coarctation (including repaired)
 - Diabetes

TABLE 9 Conditions Under Which Children Younger Than 3 Years Should Have BP Measured

- History of prematurity <32 week's gestation or small for gestational age, very low birth weight, other neonatal complications requiring intensive care, umbilical artery line
 - Congenital heart disease (repaired or unrepaired)
 - Recurrent urinary tract infections, hematuria, or proteinuria
 - Known renal disease or urologic malformations
 - Family history of congenital renal disease
 - Solid-organ transplant
 - Malignancy or bone marrow transplant
 - Treatment with drugs known to raise BP
 - Other systemic illnesses associated with HTN (neurofibromatosis, tuberous sclerosis, sickle cell disease,¹¹⁴ etc)
 - Evidence of elevated intracranial pressure
-

TABLE 8 Common Pharmacologic Agents Associated With Elevated BP in Children

Over-the-counter drugs	Decongestants Caffeine Nonsteroidal anti-inflammatory drugs Alternative therapies, herbal and nutritional supplements
Prescription drugs	Stimulants for attention-deficit/hyperactivity disorder Hormonal contraception Steroids Tricyclic antidepressants
Illicit drugs	Amphetamines Cocaine

Adapted from the Fourth Report.¹

Oscillometric Devices

- Common, easy, no digit preference
- Measure mean arterial pressure, then use proprietary algorithms to estimate systolic and diastolic pressures
- Algorithms vary among brands – no standard oscillometric BP!
- **Systematically overestimate SBP and DBP compared to auscultatory values**
- BP obtained by auscultation better predicts target organ damage
- *“An elevated initial oscillometric reading should be ignored...”* p19

Aggregate Evidence Quality

Grade B

Benefits

Use of auscultatory readings prevents potential misclassification of patients as hypertensive because of inaccuracy of oscillometric devices

Risks, harm, cost

Auscultation requires more training and experience and has flaws such as digit preference

Benefit–harm assessment

Benefit exceeds harm

Intentional vagueness

None

Role of patient preferences

Patients may prefer the convenience of oscillometric monitors

Exclusions

None

Strength

Strong recommendation

Key references

86,88,128–136

- **“Trained health care professionals in the office setting should make a diagnosis of HTN if a child or adolescent has auscultatory confirmed BP readings \geq 95th percentile at 3 different visits”**

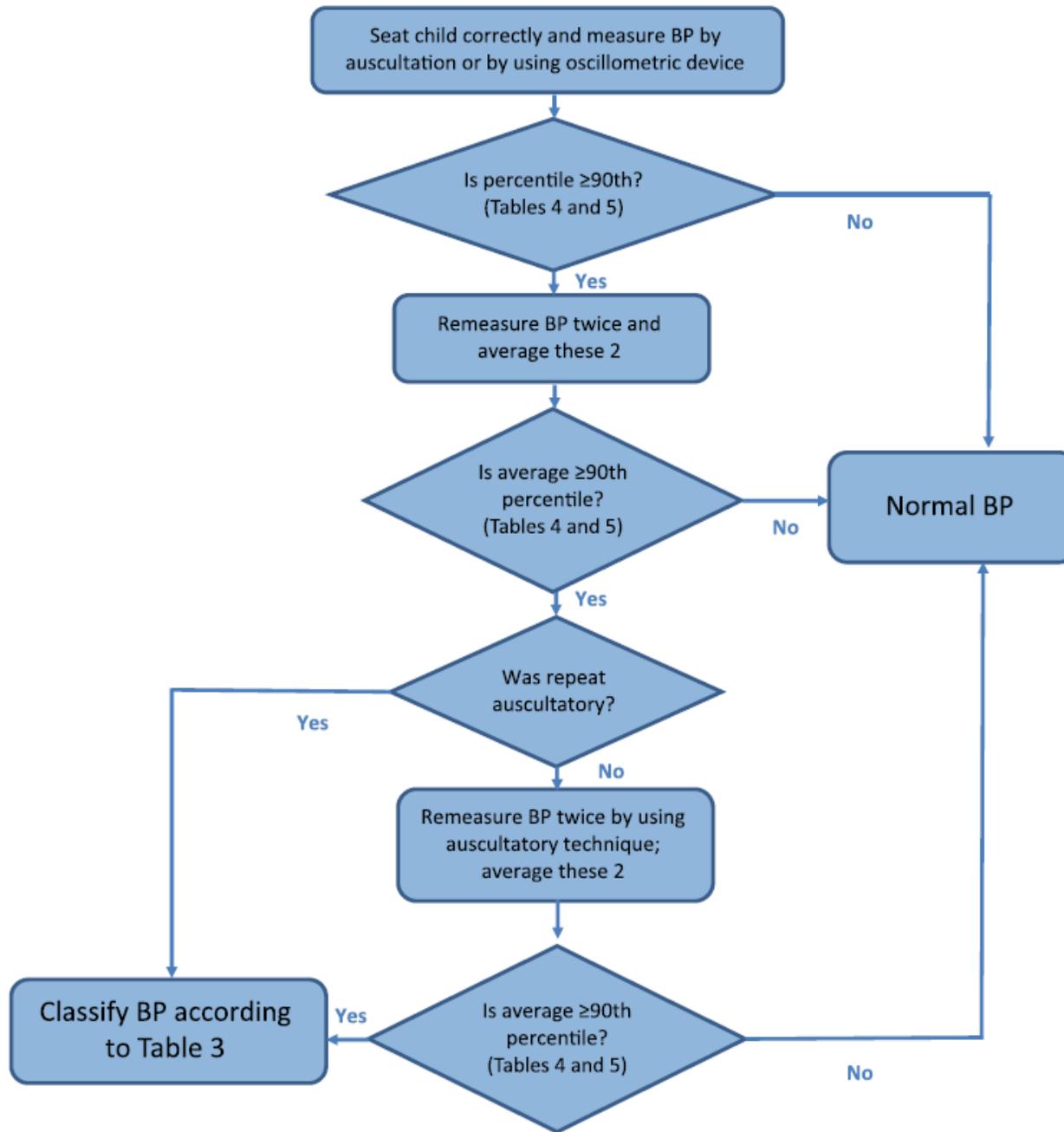


FIGURE 3
Modified BP measurement algorithm.

After a BP measurement is confirmed

TABLE 11 Patient Evaluation and Management According to BP Level

BP Category (See Table 3)	BP Screening Schedule	Lifestyle Counseling (Weight and Nutrition)	Check Upper and Lower Extremity BP	ABPM ^a	Diagnostic Evaluation ^b	Initiate Treatment ^c	Consider Subspecialty Referral
Normal	Annual	X	—	—	—	—	—
Elevated BP	Initial measurement	X	—	—	—	—	—
	Second measurement: repeat in 6 mo	X	X	—	—	—	—
	Third measurement: repeat in 6 mo	X	—	X	X	—	X
Stage 1 HTN	Initial measurement	X	—	—	—	—	—
	Second measurement: repeat in 1–2 wk	X	X	—	—	—	—
	Third measurement: repeat in 3 mo	X	—	X	X	X	X
Stage 2 HTN ^d	Initial measurement	X	X	—	—	—	—
	Second measurement: repeat, refer to specialty care within 1 wk	X	—	X	X	X	X

Elevated BP

BP Category (See Table 3)	BP Screening Schedule	Lifestyle Counseling (Weight and Nutrition)	Check Upper and Lower Extremity BP	ABPM ^a	Diagnostic Evaluation ^b	Initiate Treatment ^c	Consider Subspecialty Referral
Normal Elevated BP	Annual	X	—	—	—	—	—
	Initial measurement	X	—	—	—	—	—
	Second measurement: repeat in 6 mo	X	X	—	—	—	—
	Third measurement: repeat in 6 mo	X	—	X	X	—	X

Stage 1 HTN evaluation

BP Category (See Table 3)	BP Screening Schedule	Lifestyle Counseling (Weight and Nutrition)	Check Upper and Lower Extremity BP	ABPM ^a	Diagnostic Evaluation ^b	Initiate Treatment ^c	Consider Subspecialty Referral
Stage 1 HTN	Initial measurement	X	—	—	—	—	—
	Second measurement: repeat in 1–2 wk	X	X	—	—	—	—
	Third measurement: repeat in 3 mo	X	—	X	X	X	X

Stage 2 HTN evaluation

BP Category (See Table 3)	BP Screening Schedule	Lifestyle Counseling (Weight and Nutrition)	Check Upper and Lower Extremity BP	ABPM ^a	Diagnostic Evaluation ^b	Initiate Treatment ^c	Consider Subspecialty Referral
Stage 2 HTN ^d	Initial measurement	X	X	—	—	—	—
	Second measurement: repeat, refer to specialty care within 1 wk	X	—	X	X	X	X

Ambulatory blood pressure monitoring (ABPM)

- Recommended to confirm hypertension in patients with elevated BP ≥ 1 year, stage 1 HTN over 3 clinic visits
- Should be strongly considered in children and adolescents with high-risk conditions to assess HTN severity and determine if abnormal circadian BP patterns are present, which may indicate risk for target organ damage

TABLE 12 High-Risk Conditions for Which ABPM May Be Useful

Condition	Rationale
Secondary HTN	Severe ambulatory HTN or nocturnal HTN indicates higher likelihood of secondary HTN ^{161,167}
CKD or structural renal abnormalities	Evaluate for MH or nocturnal HTN, ^{168–172} better control delays progression of renal disease ¹⁷³
T1DM and T2DM	Evaluate for abnormal ABPM patterns, ^{174,175} better BP control delays the development of MA ^{176–178}
Solid-organ transplant	Evaluate for MH or nocturnal HTN, better control BP ^{179–188}
Obesity	Evaluate for WCH and MH ^{23,189–192}
OSAS	Evaluate for nondipping and accentuated morning BP surge ^{43,46,193,194}
Aortic coarctation (repaired)	Evaluate for sustained HTN and MH ^{58,112,113}
Genetic syndromes associated with HTN (neurofibromatosis, Turner syndrome, Williams syndrome, coarctation of the aorta)	HTN associated with increased arterial stiffness may only be manifest with activity during ABPM ^{58,195}
Treated hypertensive patients	Confirm 24-h BP control ¹⁵⁵
Patient born prematurely	Evaluate for nondipping ¹⁹⁶
Research, clinical trials	To reduce sample size ¹⁹⁷

ABPM

- More accurate for the diagnosis of HTN than clinic-measured BP
- More predictive of future BP
- Can assist in the detection of secondary HTN
- More reproducible than casual or home BP measurements

Evaluation of HTN

- History
 - Perinatal: maternal HTN, LBW, preterm birth, umbilical catheter placement
 - Nutritional:
 - elevated sodium intake associated with elevated BP/HTN
 - Identify high-fat foods, sugar-sweetened beverages, inadequate fruit/veggie intake
 - Physical activity
 - Psychosocial
 - Adverse experiences in utero and during childhood associated with adult-onset HTN
 - Stress/anxiety may suggest WCH
 - Starting at 11 y/o, ask about smoking, alcohol, drug use
 - Family history: 1st and 2nd degree relatives

Physical exam

- Height, weight, BMI, %iles
- BP in both arms and 1 leg
 - 2nd visit with elevated BP or Stage1 HTN; 1st visit with Stage 2 HTN
- Femoral pulses
- Exam directed at secondary causes of hypertension
 - Extensive discussion of secondary causes in the *Guideline*

Screening tests

TABLE 10 Screening Tests and Relevant Populations

Patient Population	Screening Tests
All patients	<p>Urinalysis</p> <p>Chemistry panel, including electrolytes, blood urea nitrogen, and creatinine</p> <p>Lipid profile (fasting or nonfasting to include high-density lipoproteina and total cholesterol)</p> <p>Renal ultrasonography in those <6 y of age or those with abnormal urinalysis or renal function</p>
In the obese (BMI >95th percentile) child or adolescent, in addition to the above	<p>Hemoglobin A1c (accepted screen for diabetes)</p> <p>Aspartate transaminase and alanine transaminase (screen for fatty liver)</p> <p>Fasting lipid panel (screen for dyslipidemia)</p>
Optional tests to be obtained on the basis of history, physical examination, and initial studies	<p>Fasting serum glucose for those at high risk for diabetes mellitus</p> <p>Thyroid-stimulating hormone</p> <p>Drug screen</p> <p>Sleep study (if loud snoring, daytime sleepiness, or reported history of apnea)</p> <p>Complete blood count, especially in those with growth delay or abnormal renal function</p>

ECG

- No role for electrocardiography in screening for LVH
- Low positive predictive value – a positive test is rarely associated with actual disease

Echocardiography

- Should be performed at the time of consideration of pharmacologic treatment.
- Repeat at 6-12 month intervals to monitor improvement or progression of established LVH
- Repeat in 12 month intervals if initially negative but
 - Stage 2 HTN
 - Secondary HTN
 - Chronic Stage 1 HTN incompletely treated

Who do we investigate further?

- Children <6
- Concerning findings on history, physical, screening labs
- KAS 11: *“Children and adolescents ≥ 6 years of age do not require an extensive evaluation for secondary causes of HTN if they have a positive family history of HTN, are overweight or obese, and/or do not have history or physical exam findings suggestive of a secondary cause of HTN.”*
- Extensive discussion of secondary causes in *Guideline*

Imaging for Renovascular Disease

- Renal ultrasound
 - < 6y/o with HTN
 - Abnormal UA or renal function on screening labs
- Doppler renal ultrasonography
 - Cooperative, normal-weight children, ≥ 8 y/o
 - Suspicion of renal vascular disease (stage 2 HTN, significant diastolic HTN, HTN + Hypokalemia, bruits over renal arteries, notable size discrepancy between kidneys)
- CTA or MRA are poorly studied, but may be considered
- Invasive angiography is the gold standard

Treatment

- Goal:
 - <90%ile and
 - <130/80 in adolescents ≥ 13 y/o
- Diet
 - DASH diet
 - High olive oil
- Exercise
 - Moderate-vigorous, 30-60min per session, 3-5 days/week
 - Benefit is probably present but modest
- Stress reduction
 - Mindfulness, transcendental meditation, and yoga have some evidence of decreasing BP and/or LVMI

TABLE 16 DASH Diet Recommendations

Food	Servings per Day
Fruits and vegetables	4–5
Low-fat milk products	≥ 2
Whole grains	6
Fish, poultry, and lean red meats	≤ 2
Legumes and nuts	1
Oils and fats	2–3
Added sugar and sweets (including sweetened beverages)	≤ 1
Dietary sodium	<2300 mg per d

- KAS 20 *“At the time of diagnosis of elevated BP or HTN in a child or adolescent, clinicians should provide advice on the DASH diet and recommend moderate to vigorous physical activity at least 3 to 5 days per week (30–60 minutes per session) to help reduce BP.”*
- *“... intensive weight-loss therapy involving regular patient and/or family contact and at least 1 hour of moderate to vigorous physical activity on a daily basis should be offered to children and adolescents with obesity and HTN.”*

Medications

- Begin if
 - HTN persists despite trial of lifestyle modification
 - Symptomatic HTN
 - Stage 2 HTN without a clearly modifiable factor
 - CKD or DM with any stage of HTN
- Start low, increase every 4-6 weeks to goal
- Add new agent when initial is maxed out
- Continue lifestyle modifications

Medications

- Initiate with single agent ACEI, ARB, long-acting CCB, or thiazide diuretic
- β -blockers not recommended as first-line therapy
- ACEI/ARB **contraindicated** in pregnancy
- ACEI/ARB **recommended** if CKD, proteinuria, or DM is present
- ACEI/ARB may be less effective or require higher doses in African American patients

Sports activity

- Generally encouraged as a way to stay active!
- No evidence that exercising while hypertensive increases risk of sudden death
- Stage 2 HTN: restrict high-static sports (class IIIA-IIIC) and refer to subspecialist

Sports activity

- KAS 28 *“Children and adolescents with HTN may participate in competitive sports once hypertensive target organ effects and CV risk have been assessed”*
- KAS 29 *“Children and adolescents with HTN should receive treatment to lower BP below stage 2 thresholds before participating in competitive sports”*

Recommended approach



APPROPRIATELY
ASSESS



FOLLOW-UP



CONFIRM/STAGE



WORK-UP



TREAT/REFER

TABLE 11 Patient Evaluation and Management According to BP Level

BP Category (See Table 3)	BP Screening Schedule	Lifestyle Counseling (Weight and Nutrition)	Check Upper and Lower Extremity BP	ABPM ^a	Diagnostic Evaluation ^b	Initiate Treatment ^c	Consider Subspecialty Referral
Normal	Annual	X	—	—	—	—	—
Elevated BP	Initial measurement	X	—	—	—	—	—
	Second measurement: repeat in 6 mo	X	X	—	—	—	—
	Third measurement: repeat in 6 mo	X	—	X	X	—	X
Stage 1 HTN	Initial measurement	X	—	—	—	—	—
	Second measurement: repeat in 1–2 wk	X	X	—	—	—	—
	Third measurement: repeat in 3 mo	X	—	X	X	X	X
Stage 2 HTN ^d	Initial measurement	X	X	—	—	—	—
	Second measurement: repeat, refer to specialty care within 1 wk	X	—	X	X	X	X



Appropriately Assess

- Begin taking routine annual BPs at 3 years of age
- Use appropriate technique and cuff size
- Use *Guideline* “Quick screen” chart to trigger further investigation
- If truly elevated on full BP chart (age/gender/height):
 - Take 2 auscultatory BP readings in the right arm and average
- If elevated, classify the reading and code for
 - R03.0 - Elevated blood-pressure reading, without diagnosis of hypertension
- If Stage 2 range, check upper/lower



Follow-up

- Follow-up BP at recommended intervals
 - Elevated BP:
 - 2nd reading in 6 months (with upper/lower if still elevated)
 - 3rd reading 6 months later
 - Stage 1 HTN:
 - 2nd reading 1-2 weeks (with upper/lower if still elevated)
 - 3rd reading in 3 months
 - Stage 2 HTN
 - 2nd reading within 1 week



Confirm/Stage

- After appropriate follow-up, diagnose hypertension
- ABPM is recommended to confirm diagnosis before lab work-up



Work-up

- All
 - Urinalysis
 - Chemistry Panel
 - Lipid profile
 - Renal ultrasound
 - <6y/o or abn UA or renal function
- BMI > 95%ile
 - HbA1c
 - AST/ALT
 - Fasting lipids
- Other
 - Fasting glucose (DM)
 - TSH
 - Drug screen
 - Sleep study
 - CBC (growth delay, abn renal function)



Treat/Refer

- Elevated BP
 - If persistent over 1 year and no identified cause, consider Echo, subspecialty referral
- Stage 1
 - If persistent over 3 months, Echo and begin treatment. Consider referral, especially if LVH is present
- Stage 2
 - If confirmed in 2 readings over 1 week, begin treatment and obtain Echo
 - Restrict sports and refer to subspecialist
 - If symptomatic, BP >30mmHg over 95%ile, or >180/120, send to ED

Notes

- Lifestyle counseling should be given whenever BP measurements are taken and especially whenever elevated BP or HTN is discovered
- ABPM is recommended to confirm a diagnosis of HTN once sufficient office readings have occurred. This is an appropriate time to refer to specialist if necessary to have ABPM done.
- Elevated diastolic BP is suggestive of a secondary cause
- If BP normalizes at any point, annual BP screening should be resumed

Additionally covered in the *Guide*

- Review of quality of evidence and strength of recommendations
- Measuring and evaluating BP in infants
- Basic approach to emergent treatment of severely elevated BP
- Role of school- and home-based BP measurements
- Help in interpreting ABPM and echocardiography
- Evaluation and treatment of specific secondary causes
- Medication choices and dosing

Questions?



(problems with home
BP monitoring)

References

- Flynn JT, Kaelber DC, Baker-Smith CM, et al., and AAP Subcommittee on Screening and Management of High Blood Pressure in Children. Clinical practice guideline for screening and management of high blood pressure in children and adolescents. *Pediatrics*. 2017;140(3):e20171904
- 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, suppl 4th Report):555–576
- Wiesen J, Adkins M, Fortune S, et al. Evaluation of pediatric patients with mild-to-moderate hypertension: yield of diagnostic testing. *Pediatrics*. 2008;122(5).

Intention of Guidelines

- Provide recommendations on diagnosis, evaluation, and management of childhood HTN
- Provide outpatient clinicians with a HTN strategy

Correct BP measurement

- [AAP video](#)