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2017 AAP Guidelines for Childhood Hypertension

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Learning Objectives

- Understand the changes in the new American Academy of Pediatrics (AAP) childhood hypertension guideline and how these changes will affect the management of children and adolescents with high blood pressure.

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Rationale for the Guideline

- Significant increase in interest in childhood hypertension (HTN) since 2004 Fourth Report.
  - 3.5% of children have HTN; another 10%–11% have elevated blood pressure (BP).
    - Increase in prevalence due to obesity
  - High BP in childhood increases the risk for adult HTN and cardiovascular disease.
  - Even youth with HTN have evidence of accelerated vascular aging.

Rationale for the Guideline

- Prior pediatric HTN guidelines were issued by the National Heart, Lung, and Blood Institute (NHLBI) in 1977, 1987, 1996, and 2004.
- NHLBI ceased sponsorship of cardiovascular guidelines in 2013.
- Increased emphasis on basing new clinical practice guidelines on thorough literature reviews. (IOM)

Scope of the Guideline

- Subcommittee charged with developing an updated, evidence-based clinical practice guideline
  - Provide recommendations on diagnosis, evaluation, and management of childhood HTN
  - Aimed at practicing clinicians seeing patients in the outpatient setting

Major Changes From the Fourth Report

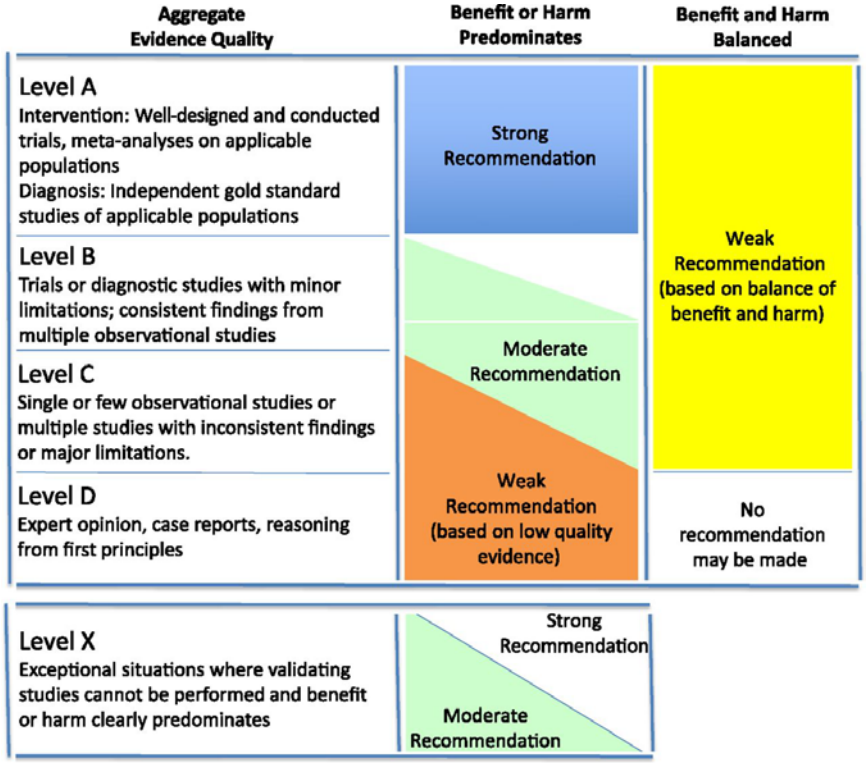
- Rigorous evidence-based methodology
- Revised definitions of BP categories; alignment with American Heart Association (AHA)/American College of Cardiology (ACC) guideline
- New normative BP tables based on BPs from normal-weight children
- Simplified screening table

Major Changes From the Fourth Report

- Emphasis on use of 24-hour ambulatory blood pressure monitoring (ABPM) to confirm HTN diagnosis
- Revised recommendations for performance of echocardiography
- Lower treatment goals for primary HTN; ABPM goal for chronic kidney disease (CKD)

Evidence-based Methodology

- PICOT (Patient, Intervention/Indicator, Comparison, Outcome, and Time) questions developed by epidemiologist; used for literature search
  - Covered 2004–2015
- Review of ~15,000 papers by Subcommittee members
- Generation of Key Action Statements (KAS)
  - Bridge Wiz Software
- Level of evidence determination based upon AAP Grading Matrix*



*AAP Steering Committee on Quality Improvement and Management. Classifying Recommendations for Clinical Practice Guidelines. *Pediatrics.* 2004;114(3):874–877

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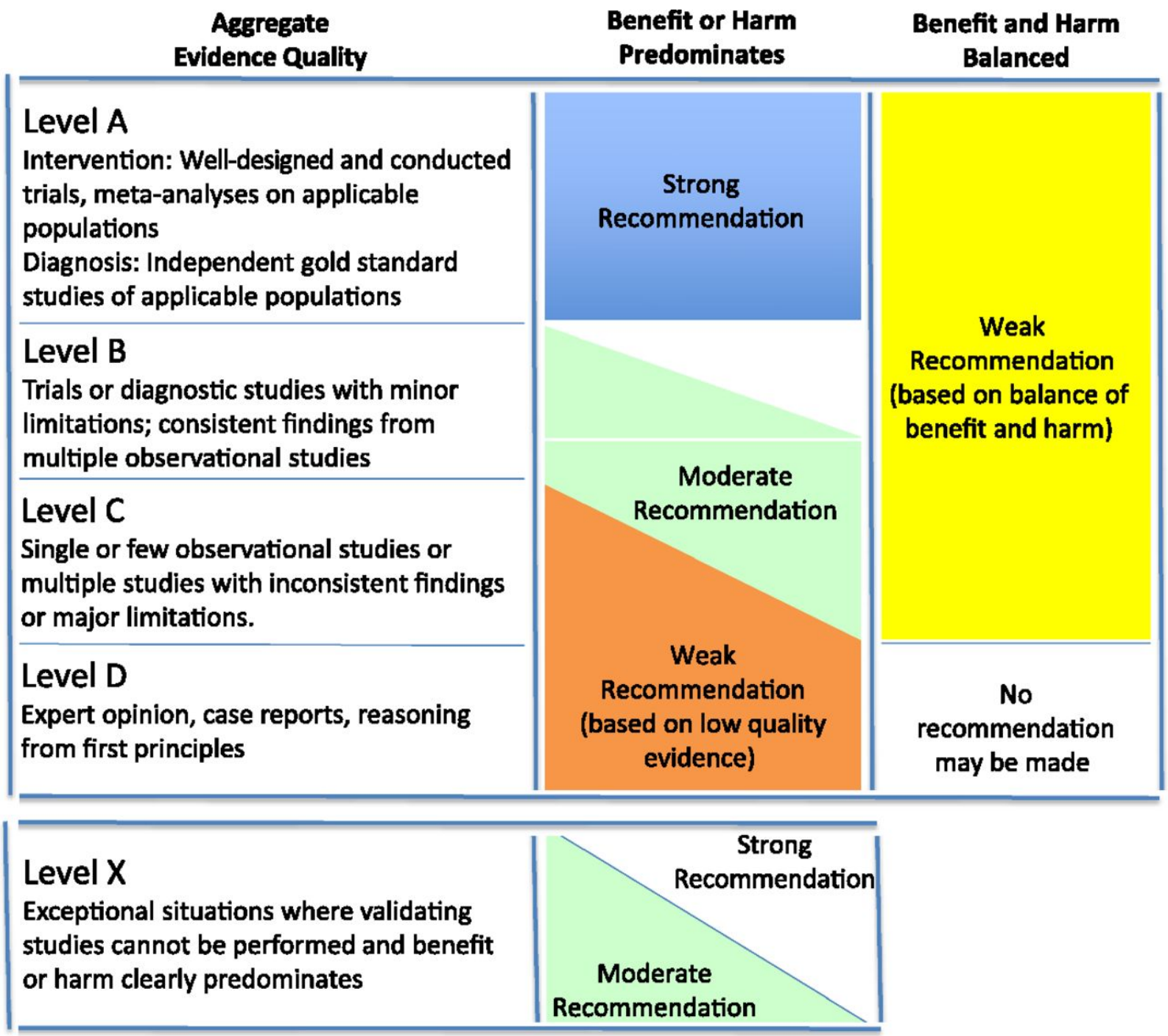
Aggregate Evidence Quality
Benefit or Harm Predominates
Benefit and Harm Balanced
Level A
Intervention: Well-designed and conducted trials, meta-analyses on applicable populations
Diagnosis: Independent gold standard studies of applicable populations
Level B
Trials or diagnostic studies with minor limitations; consistent findings from multiple observational studies
Level C
Single or few observational studies or multiple studies with inconsistent findings or major limitations.
Level D
Expert opinion, case reports, reasoning from first principles
Strong Recommendation
Moderate Recommendation
Weak Recommendation (based on low quality evidence)
Weak Recommendation (based on balance of benefit and harm)
No recommendation may be made
Level X
Exceptional situations where validating studies cannot be performed and benefit or harm clearly predominates
Strong Recommendation
Moderate Recommendation

Definition of Hypertension (1–18 years)

- Lack of outcome data on BP and cardiovascular (CV) endpoints in children and adolescents
- Childhood HTN is defined according to BP distribution in healthy children
  - This has been the approach since the first NHLBI-sponsored pediatric HTN guideline (1977)
- Subcommittee maintained similar approach due to lack of new evidence

Definition of Hypertension (1–18 years)

- Changes in HTN categorization compared to the Fourth Report:
  - BP >90th percentile now termed '*elevated BP*'
  - BP cut-points for Stage 1 and 2 HTN simplified
  - BP cut-points for adolescents ≥13 years of age are the same as in new AHA/ACC adult HTN guideline

Definition of Hypertension (1–18 years)

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

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

Definition of Hypertension in Neonates and Infants (0–1 year)

- Many factors affect BP in neonates, making it hard to precisely define HTN.
- BP values for neonates 26–44 weeks post-menstrual age have been compiled* and may be used to identify neonates with high BP.
- 2nd Task Force Report BP curves should still be used for infants 1–12 months of age.

*Dionne JM, Abitbol CL, Flynn JT. Hypertension in infancy: diagnosis, management and outcome. *Pediatr Nephrol*. 2012;27(1):17–32

New Normative Blood Pressure Tables

- 4th Report BP tables generated from BP values in ~70,000 healthy children
  - Many children had overweight or obesity
  - Inclusion of these children likely biased normative BP values upward
- New normative BP tables commissioned for this clinical practice guideline, based only on BP readings from ~50,000 normal-weight children

New Blood Pressure Tables

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

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	90th	98	99	99	100	100	101	101
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Simplified Blood Pressure Table

- Full BP tables are complicated
  - Leads to under-recognition of childhood HTN
- Simplified BP table created for use in initial screening of BP values
  - Based on 90th percentile BP values for children at 5th height percentile

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

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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

Blood Pressure Measurement Frequency

- Unclear what age is optimal to begin routine BP measurement.
- Data suggest that prevention and intervention efforts should begin early.
- New guideline does not change recommendation to begin BP measurement at age 3.
  - Now, only annual measurement is recommended unless risk factors are present.

KAS 1: Blood Pressure Measurement Frequency

Key Action Statement 1. BP should be measured annually in children and adolescents ≥3 years of age (grade C, moderate recommendation).

Aggregate Evidence Quality	Grade C
Benefits	Early detection of asymptomatic HTN; prevention of short- and long-term HTN-related morbidity
Risks, harm, cost	Overtesting, misclassification, unnecessary treatment, discomfort from BP measurement procedure, time involved in measuring BP
Benefit–harm assessment	Benefit of annual BP measurement exceeds potential harm
Intentional vagueness	None
Role of patient preferences	Increased visit time, discomfort of cuff
Exclusions	None
Strength	Moderate recommendation
Key references	10,60,102,103

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KAS 2: Blood Pressure Measurement Frequency

- BP should be checked in all children and adolescents ≥3 years of age at every health care encounter if they have obesity, are taking medications known to increase BP, have renal disease, a history of aortic arch obstruction or coarctation, or diabetes.

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Repeat High Blood Pressure Measurements

- BP in childhood may vary considerably between visits and even during the same visit
  - Many potential etiologies for isolated elevated BP in children and adolescents
- Therefore, the clinician should:
  - Repeat high BP readings at a visit
  - Obtain multiple measurements over time before diagnosing HTN

KAS 3: Diagnosis of Hypertension

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

*≥130/80 in adolescents ≥13 years of age

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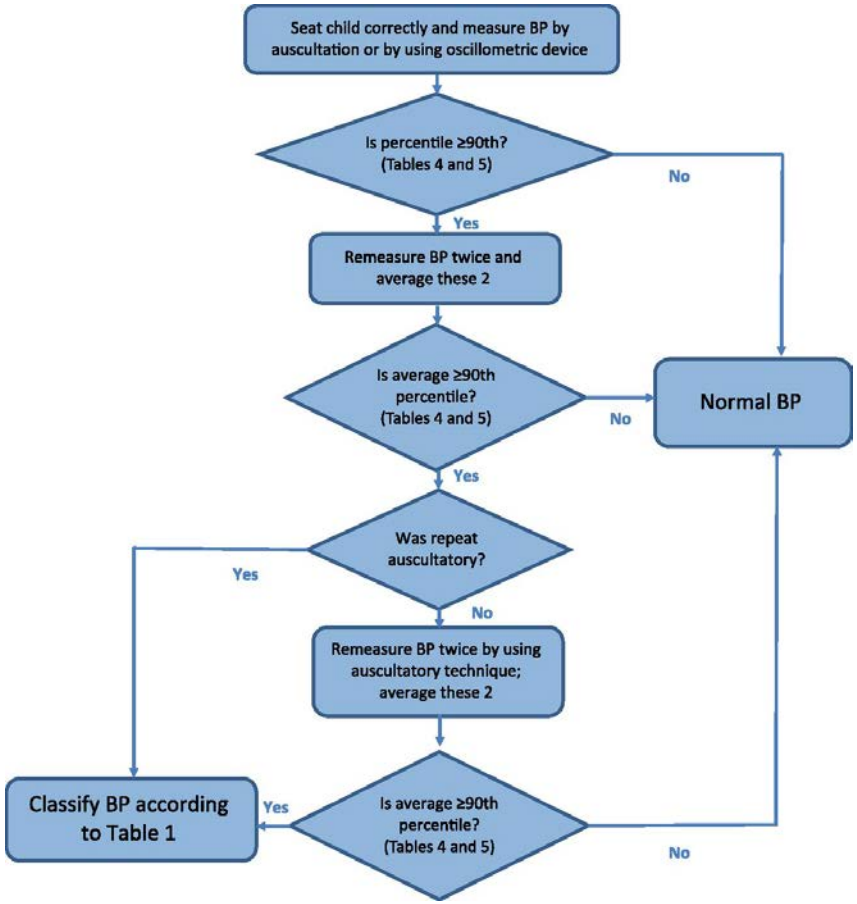
Blood Pressure Measurement and Classification



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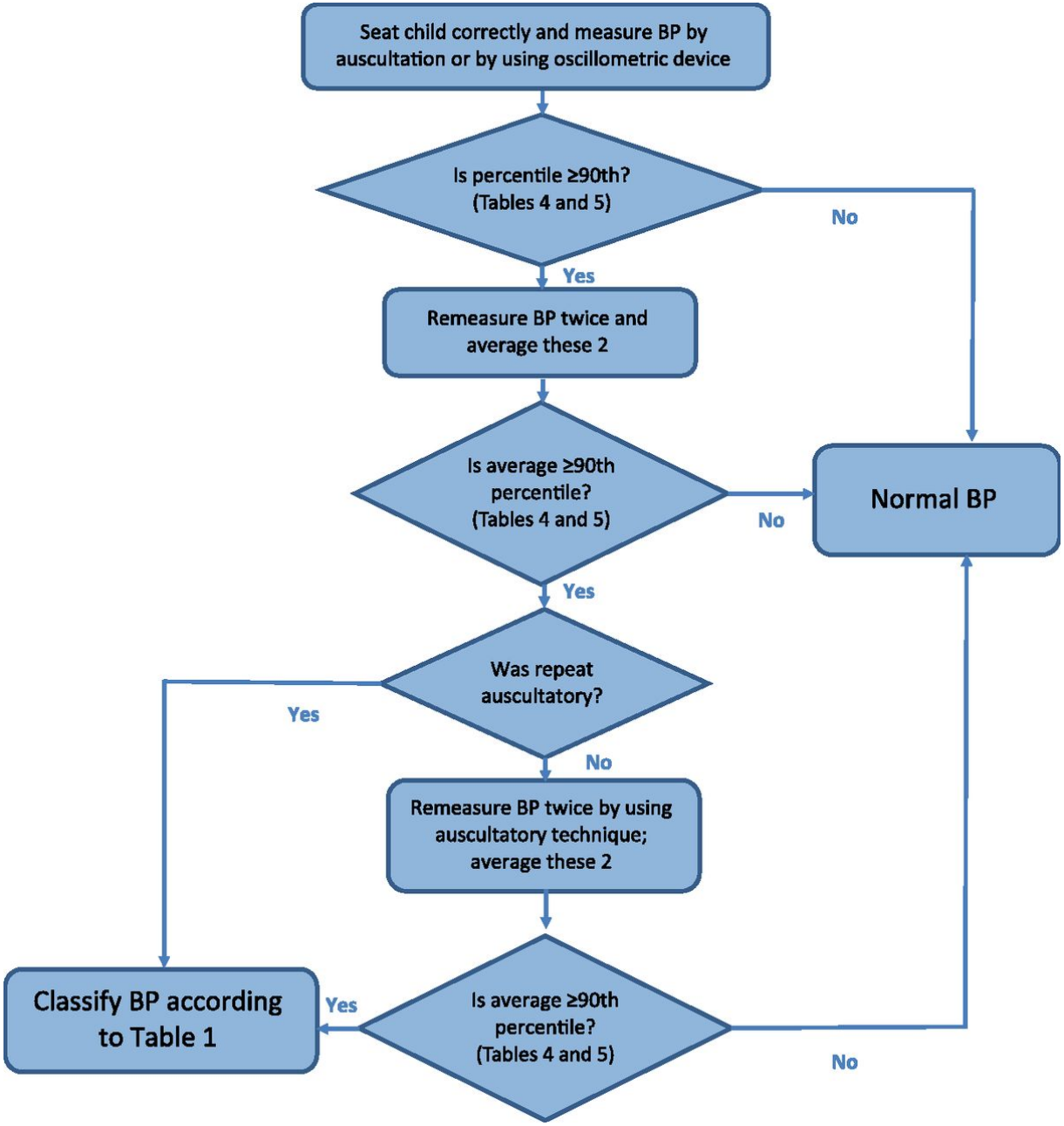

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Patient Evaluation and Management by Blood Pressure Level

BP Category (see Table 3)	BP Screening Schedule	Lifestyle Counseling (Weight, Nutrition)	Check Upper and Lower Extremity BP	ABPM	Diagnostic Evaluation	Initiate Treatment	Consider Sub-specialty Referral
Normal	Annual	X					
Elevated BP	Initial measurement	X					
	Second measurement: Repeat in 6 months	X	X				
	Third measurement: Repeat in 6 months	X		X	X		X
Stage 1 HTN	Initial measurement	X					
	Second measurement: Repeat in 1-2 weeks	X	X				
	Third measurement: Repeat in 3 months	X		X	X	X	X
Stage 2 HTN	Initial measurement	X	X				
	Second measurement: Repeat/refer to specialty care within 1 week	X		X	X	X	X

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	Third measurement: Repeat in 6 months	X		X	X		X
Stage 1 HTN	Initial measurement	X					
	Second measurement: Repeat in 1-2 weeks	X	X				
	Third measurement: Repeat in 3 months	X		X	X	X	X
Stage 2 HTN	Initial measurement	X	X				
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Stage 2 HTN	Initial measurement	X	X				
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Stage 2 HTN	Initial measurement	X	X				
	Second measurement: Repeat/refer to specialty care within 1 week	X		X	X	X	X

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

Management on Basis of Office Blood Pressure: Normal Blood Pressure

- If BP is normal or normalizes after repeat readings (i.e. <90th percentile), then no additional action is needed.
  - Give standard lifestyle recommendations (nutrition, sleep, physical activity, etc.).
  - Recheck BP at next routine well-care visit.

Management on Basis of Office Blood Pressure: Elevated Blood Pressure

1. If BP is elevated
   - Lifestyle recommendations at each visit
   - Recheck BP in 6 months (auscultation)
2. If BP is still elevated after 6 months
   - Check upper and lower extremity BP
   - Recheck BP in 6 months (auscultation)
3. If BP is still elevated after 12 months (i.e. 3 time points)
   - ABPM (prior to diagnostic evaluation)
   - Diagnostic evaluation
   - Consider subspecialty referral
4. If BP normalizes at any point, return to annual screening

Management on Basis of Office Blood Pressure: Stage 1 Hypertension

1. If BP is Stage 1 HTN and patient is asymptomatic
   - Lifestyle recommendations at each visit
   - Recheck BP in 1–2 weeks (auscultation)
2. If BP is still Stage 1 HTN after 1–2 weeks
   - Check upper and lower extremity BP
   - Recheck BP in 3 months (auscultation)
3. If BP is still Stage 1 HTN after 3 visits
   - ABPM (prior to diagnostic evaluation)
   - Diagnostic evaluation
   - Consider subspecialty referral
   - Initiate treatment (primary care provider or subspecialist)

Management on Basis of Office Blood Pressure: Stage 2 Hypertension

1. If BP is Stage 2 HTN and patient is asymptomatic
   - Lifestyle recommendations at each visit, if appropriate
   - Check upper and lower extremity BP
   - Recheck BP or refer to subspecialty care within 1 week
2. If BP is still Stage 2 HTN after 1 week
   - ABPM (prior to diagnostic evaluation)
   - Diagnostic evaluation
   - Consider subspecialty referral within 1 week
   - Initiate treatment (primary care physician, subspecialist)

If patient is symptomatic or BP is >30 mm Hg above the 95th percentile (or >180/120 in an adolescent), refer for emergency care.

Oscillometric vs Auscultatory Blood Pressure

- Pediatric normative BP values are based on auscultation.
- Despite this, oscillometric devices are commonly used in many healthcare settings.
  - Several perceived benefits
  - Known inaccuracies

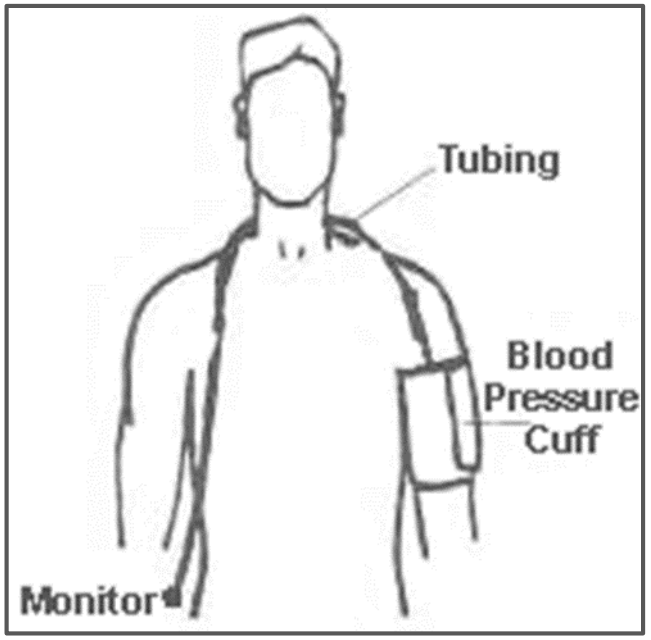
KAS 5: Oscillometric vs Auscultatory Blood Pressure

- Oscillometric devices may be used for BP screening in children and adolescents. When doing so, providers should use a device that has been validated in the pediatric age group. If elevated BP is suspected on the basis of oscillometric readings, confirmatory measurements should be obtained by auscultation.

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

Ambulatory Blood Pressure Monitoring

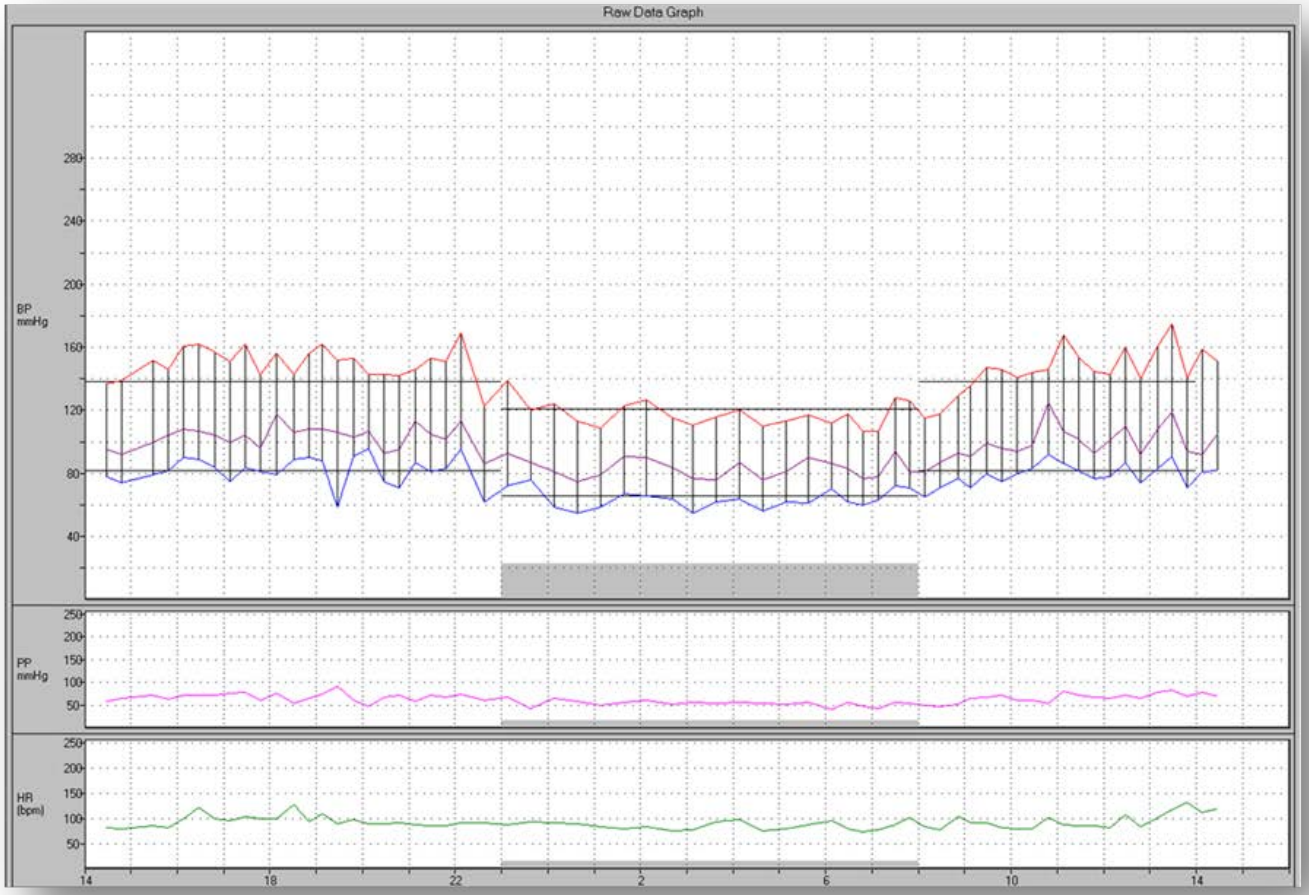
- Patient wears a BP cuff continually for 24 hours
  - Readings q20–30 min
- Captures BP in many settings:
  - Home, school, work
  - Awake, asleep
- ABPM allows for evaluation of
  - Out-of-office BP
  - Circadian BP patterns



Blood Pressure Patterns by Office BP and Ambulatory BP

	Ambulatory BP	Office BP
Normal BP	Normal	Normal
Sustained HTN	Elevated	Elevated
White Coat HTN	Normal	Elevated
Masked HTN	Elevated	Normal

ABPM – Ambulatory Hypertension



Ambulatory Blood Pressure Monitoring

- Use of ABPM in pediatric age group is increasing.
- Normative data tables are available based on age, sex, and height.
- Consensus guidelines for interpretation are available.*
- Mentioned as ‘useful’ but not endorsed in 2004 Fourth Report.

*Flynn JT, Daniels S, Hayman L, et al. Update: ambulatory blood pressure monitoring in children and adolescents: a scientific statement from the American Heart Association. *Hypertension*. 2014;63(5):1116–1135

Ambulatory Blood Pressure Monitoring

- New data available regarding
  - Frequency of white coat hypertension (WCH), masked hypertension (MH)
  - Associations with hypertensive target organ damage
  - Application in high-risk populations: CKD, diabetes mellitus, aortic coarctation, solid organ transplantation
  - Cost-effectiveness in pediatric HTN evaluation

KAS 6: Ambulatory Blood Pressure Monitoring to Confirm Hypertension

- ABPM should be performed for confirmation of HTN in children and adolescents with office BP measurements in the elevated BP category for ≥1 year or with Stage 1 HTN over 3 clinic visits.

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

Ambulatory Blood Pressure Monitoring Procedure and White Coat Hypertension

- KAS 8: ABPM should be performed by using a standardized approach (see Table 13) with monitors that have been validated in a pediatric population, and studies should be interpreted by using pediatric normative data.

- KAS 9: Children and adolescents with suspected WCH should undergo ABPM. Diagnosis is based on the presence of mean systolic blood pressure (SBP) and diastolic blood pressure (DBP) <95th percentile and SBP and DBP load <25%.

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

KAS 7: Ambulatory Blood Pressure Monitoring in High-Risk Conditions

- Routine performance of ABPM 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 increased risk for target organ damage.

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

Table 12: High-Risk Conditions

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]

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

Home Blood Pressure Measurement

- Pediatric studies do not show that BP measurements obtained in settings other than the office or by ABPM are sufficiently reliable to establish a diagnosis of HTN.
- Practical concerns:
  - Little normative data
  - Few devices validated for children
  - Cuff sizes limited
  - No consensus about how many measurements across what period of time are needed to evaluate BP

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KAS 10: Home Blood Pressure Measurement

- Home BP monitoring should not be used to diagnose HTN, MH, or WCH but may be a useful adjunct to office and ambulatory BP measurement after HTN has been diagnosed.

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

Home Blood Pressure Measurement

- This recommendation should not discourage home or school BP measurement for screening or monitoring purposes.
- Home measurement is convenient and enables repeated measurements over time.
- Results differ from office and ABPM measurements.
- Commonly used for treatment monitoring.*

*Woroniecki RP, Flynn JT. How are hypertensive children evaluated and managed? A survey of North American pediatric nephrologists. *Pediatr Nephrol.* 2005;20(6):791–797

School Blood Pressure Measurement

- Evidence to support use of school measurements is limited.
- Though useful in research, because of insufficient evidence and lack of established protocols, the routine use of school-based measurements to diagnose HTN cannot be recommended.
- School-based BP measurement, however, can be a useful tool to identify children who require formal evaluation as well as a helpful adjunct in monitoring diagnosed HTN.

Note: School-based health clinics are considered part of systems of pediatric primary care and these comments would not apply to them.

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Primary Hypertension

- Predominant cause of HTN in US children
- Characteristics include:
  - ≥6 years of age; positive family history of HTN; obesity/overweight
- Severity of BP elevation is similar between primary and secondary HTN
  - Diastolic HTN predictive of secondary cause
  - Systolic HTN predictive of primary HTN

KAS 11: Primary Hypertension

- 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 examination findings suggestive of a secondary cause of HTN.

Secondary Causes: Renal/Renovascular

- Retrospective case series of children with secondary HTN show that:
  - Renal parenchymal disease or renal structural abnormalities account for 34%–76%
  - Renovascular disease accounts for 12%–13%
- Renal causes especially likely among children <6 years of age

Secondary Causes: Aortic Coarctation

- Coarctation is a congenital abnormality of the aortic arch, characterized by discrete narrowing of the aortic arch at the level of the aortic isthmus.
- Children with various syndromes, such as neurofibromatosis, Williams syndrome, Alagille syndrome, and Takayasu arteritis, are at risk for abdominal aortic obstruction.
- Prevalence of HTN among children with a history of repaired aortic coarctation is 17% to 77%, even among those without evidence of re-coarctation.
- ABPM use is strongly encouraged to monitor for HTN.

Patient Evaluation

- Once HTN diagnosis has been confirmed, patient should be evaluated to:
  - Determine underlying cause
  - Assess for comorbidities
- Evaluation should include:
  - Patient and family history
  - Physical examination
  - Laboratory and imaging studies

KAS 13: History and Physical

- In children and adolescents being evaluated for high BP, the provider should obtain a perinatal history, appropriate nutritional history, physical activity history, psychosocial history, and family history, and perform a physical examination to identify findings suggestive of secondary causes of HTN.

Physical Examination

- Exam should be conducted to identify underlying secondary causes of HTN, or target-organ effects of HTN
- Detailed in Table 14 in the clinical practice guideline

Laboratory Evaluation

- Laboratory testing may reveal or provide clues to underlying secondary causes of HTN.
- Should include screening tests in all patients, plus additional tests in selected patients based on clues from history, physical exam, or initial screening tests.

Table 10: Screening Tests

TABLE 10 Screening Tests and Relevant Populations

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

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Left Ventricular Hypertrophy and Echocardiography

- Prevalence of left ventricular hypertrophy (LVH) is 30%–40% in childhood HTN
- LVH increases CV risk independently of BP and body mass index
- 2004 Fourth Report recommended obtaining echocardiography at time of diagnosis of HTN
  - If LVH is present, indication to start antihypertensive medications
  - Serial echocardiography to assess treatment efficacy

KAS 15: Echocardiography

- It is recommended that echocardiography be performed to assess for cardiac target organ damage (left ventricular mass, geometry, and function) at the time of consideration of pharmacologic treatment of HTN.

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

Left Ventricular Hypertrophy and Echocardiography

- LVH definitions updated:
  - >51 g/$m^{2.7}$ or >115 g/body surface area (BSA) in boys, >95 g/BSA in girls
- Repeat echocardiography to monitor patients with LVH or abnormal left ventricular function
- Frequent echocardiography in the absence of LVH or abnormal left ventricular function is discouraged

Overall Treatment Goals

- Achieve a BP level that
  - Reduces risk for target organ damage
  - Reduces risk for hypertension-related cardiovascular disease in adulthood
- Achieve an optimal BP level:
  - <90th percentile / <130/80 mm Hg in adolescents

KAS 19: Overall Treatment Goals

- In children and adolescents diagnosed with HTN, the treatment goal with non-pharmacologic and pharmacologic therapy should be a reduction in SBP and DBP to <90th percentile and <130/80 mm Hg in adolescents ≥13 years of age.

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

KAS 20: Lifestyle Interventions

- At the time of diagnosis of elevated BP or HTN in a child or adolescent, clinicians should provide advice on the DASH (Dietary Approaches to Stop Hypertension) diet and recommend moderate to vigorous physical activity at least 3 to 5 days per week (30–60 min per session) to help reduce BP.

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

Pharmacologic Treatment

- Prescribe antihypertensive medications if:
  - Patient has failed at least 6 months of lifestyle change
  - Symptomatic HTN
  - Stage 2 HTN without clearly modifiable risk factor (e.g. obesity)
- 1st line agents may include:
  - Angiotensin-converting enzyme (ACE) inhibitor or angiotensin receptor blocker (ARB)
  - Long-acting calcium channel blocker
  - Thiazide diuretic
- In CKD or diabetes:
  - ACE inhibitor or ARB

KAS 21: Pharmacologic Treatment

- In hypertensive children and adolescents who have failed lifestyle modifications, particularly those who have LVH on echocardiography, symptomatic HTN, or Stage 2 HTN without a clearly modifiable factor, clinicians should initiate pharmacologic treatment with an ACE inhibitor, ARB, long-acting calcium channel blocker, or thiazide diuretic.

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

Treatment Follow-Up and Monitoring

- Patients treated with antihypertensive medications should be seen every 4–6 weeks for dose adjustments until goal BP is reached, then every 3–4 months.
- Patients treated with lifestyle change only should be seen every 3–6 months to assess success of BP reduction and to reassess need for pharmacologic treatment.

KAS 22: Ambulatory Blood Pressure Monitoring and Treatment

- ABPM may be used to assess treatment effectiveness in children and adolescents with HTN, especially when clinic and/or home BP measurements indicate insufficient BP response to treatment.

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

KAS 23: Chronic Kidney Disease

- Children and adolescents with CKD should be evaluated for HTN at each medical encounter.
- Children or adolescents with both CKD and HTN should be treated to lower 24-hour mean arterial pressure <50th percentile by ABPM.
- Regardless of apparent control of BP with office measures, children and adolescents with CKD and a history of HTN should have BP assessed by ABPM at least yearly to screen for MH.

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

KAS 26: Diabetes

- Children and adolescents with type 1 diabetes mellitus or type 2 diabetes mellitus should be evaluated for HTN at each medical encounter and treated if BP ≥95th percentile or >130/80 mm Hg in adolescents ≥13 years of age.

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

Hypertension and the Athlete

- There is no evidence that exercising while hypertensive increases sudden death risk.
- Physical activity and improved physical fitness are treatments for HTN.
- Treatment of HTN improves sports performance.
  - However, if LVH or other target organ damage is present, should withhold from competition until BP is controlled.

KAS 28 and 29: Hypertension and the Athlete

- Children and adolescents with HTN may participate in competitive sports once hypertensive target organ effects and CV risk have been assessed.
- Children and adolescents with HTN should receive treatment to lower BP below Stage 2 thresholds before participation in competitive sports.

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

Major Points

- Changes in HTN categorization
- Revised BP tables and screening table
- ABPM to confirm HTN diagnosis and for special populations
- Lower treatment goals and emphasis on BP reduction, not LVH

Implications for Practice

- Review manual BP measurement with your staff and ensure that appropriate equipment is available in your office.
- Post new simplified BP table and have more detailed BP tables available for consultation.
- Develop process for performing/obtaining 24-hour ABPM.
- Familiarize yourself with indications for and approaches to treatment of HTN.

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