Hypertension Essentials

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Prevalence

- Second to asthma and obesity in prevalence of chronic diseases in childhood
- 1970's and 1980's: 0.3%-1.2% of children had HTN

➢ Current estimates:

- 3-5% of all children have HTN
- 3-24% of all children have elevated BPs
- High BPs consistently greater in boys (15%–19%) than in girls (7%–12%)
  - 20-47% of *obese* children are hypertensive
    - Prevalence of HTN in children increases with increasing BMI percentile
- Increasing prevalence linked to obesity, high salt food intake, sedentary life-style
- Underestimate of disease?
  - Providers don't routinely measure BP
  - Providers don't routinely recognize BP elevations

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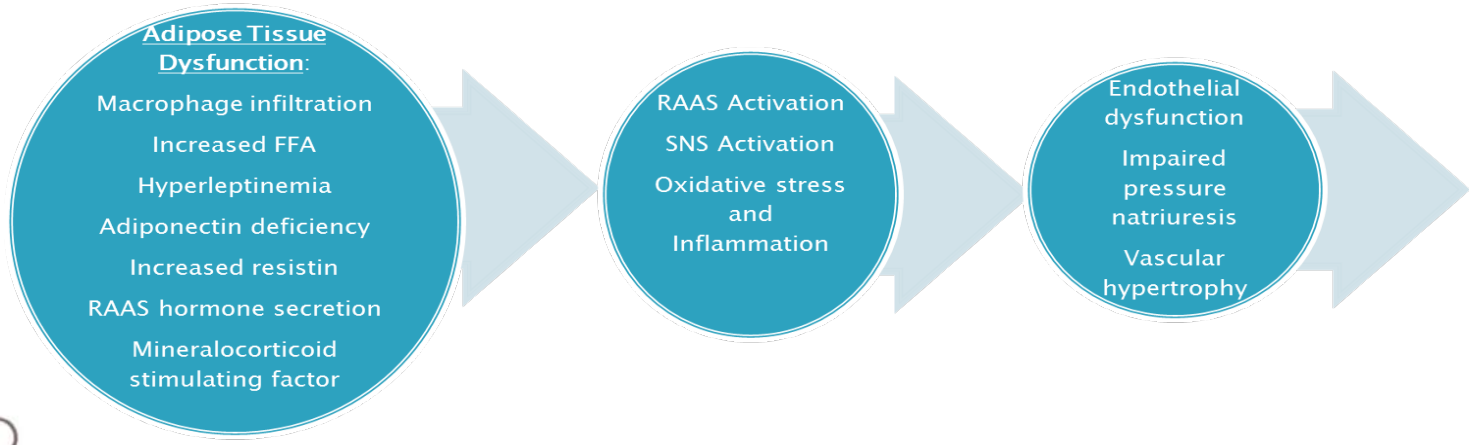
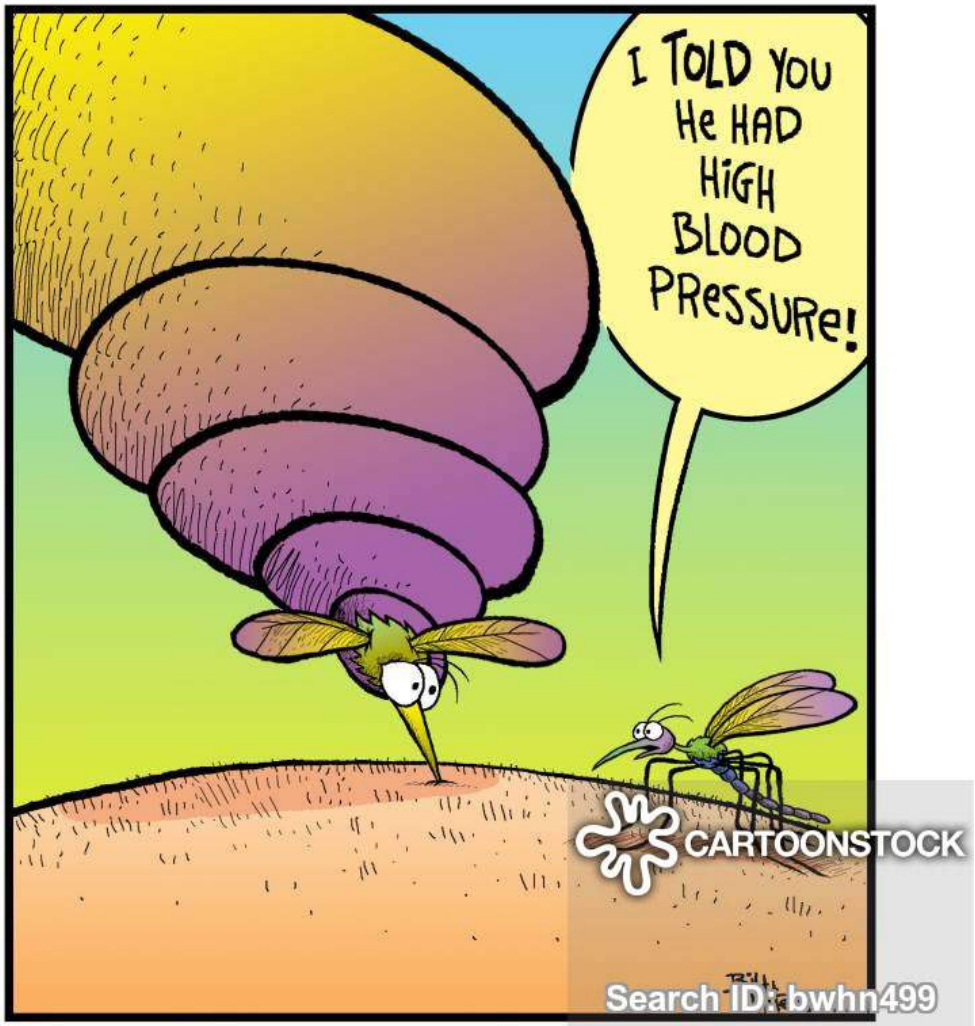
Hypertension and Obesity

- **Obesity prevalence and role in HTN**
  - Prevalence (2-19 years old) remains high at 17% based on NHANES 2011-2012 data
  - Obstructive sleep apnea common
  - Dysfunctional adipocyte -> imbalance in expression of pro- and anti-inflammatory adipokines -> Hypertension



Dorresteijn et al, *Obesity Reviews*, 2012.


I TOLD YOU He HAD HIGH BLOOD PRESSURE!
CARTOONSTOCK
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Why is identifying and controlling hypertension so important?

- Pediatric hypertension correlates to hypertension in adulthood
- Childhood hypertension is a risk factor for cardiovascular disease in adults
- Poor BP control is the number one attributable risk of death in the world (WHO) – accounts for 62% of cerebrovascular disease and 49% of ischemic heart disease in adults

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Updated Guidelines for Pediatric Hypertension

The Fourth Report on the Diagnosis, Evaluation, and Treatment of High Blood Pressure in Children and Adolescents

National High Blood Pressure Education Program Working Group on High Blood Pressure in Children and Adolescents. *Pediatrics* 2004; 114; 555

Clinical Practice Guideline for Screening and Management of High Blood Pressure in Children and Adolescents

Flynn JT, Kaelber DC, Baker-Smith CM, et al. *Pediatrics* 2017;140(3):e20171904

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Changes from 2004 Report

1. Replacement of the term "prehypertension" with the term "elevated blood pressure"

2. New normative pediatric blood pressure (BP) tables based on normal-weight children
   - BP values in new update several mmHg lower than similar tables in Fourth Report

3. Simplified screening table for identifying BPs needing further evaluation

4. Simplified BP classification in adolescents ≥13 years of age that aligns with the American Heart Association and American College of Cardiology adult BP guidelines

Prior staging of hypertension

	1-17 yrs old	≥ 18 yrs old
Normal	<90th percentile	<120/80 mmHg
Pre-hypertension	90th to 95th percentile, or BP greater than 120/80	120-139/80-89 mmHg
Stage 1 hypertension	95th to 99th percentile + 5mmHg	140-159/90-99 mmHg
Stage 2 hypertension	≥ 99th percentile + 5mmHg	≥ 160/100 mmHg

BP%iles according to age, gender, and height

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The Fourth Report on the Diagnosis, Evaluation, and Treatment of High Blood Pressure in Children and Adolescents
Pediatrics 2004;114;555

Staging of hypertension according to current guidelines

	1-13 yrs old	≥ 13 yrs old
Normal	<90th percentile	<120/<80 mmHg
Elevated BP	≥90th to 95th percentile, or 120/80 mmHg to <95%ile (whichever is lower)	120/<80 to 129/<80 mmHg
Stage 1 hypertension	≥95th to 95th %ile + 12 mmHg or 130/80 to 139/89 mmHg (whichever is lower)	130/80 to 139/89 mmHg
Stage 2 hypertension	≥ 95th percentile + 12 mmHg or ≥ 140/90 mmHg (whichever is lower)	≥ 140/90 mmHg

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Flynn JT, Kaelber DC, Baker-Smith CM, et al. Clinical Practice Guideline for Screening and Management of High Blood Pressure in Children and Adolescents. *Pediatrics.* 2017;140(3):e20171904

Apps to calculate BP percentiles

World Kidney Day™

Pediatric Blood Pressure Guide 4+

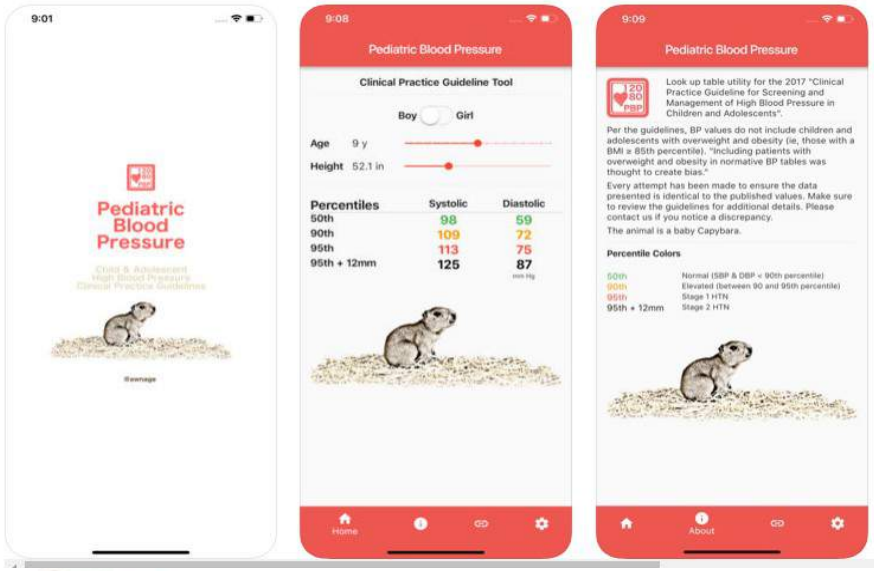
Clinical Practice Tool

Gregory Drake Wilson

★★★★★ 4.3, 6 Ratings

$0.99

Screenshots iPhone iPad



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PediBP 12+

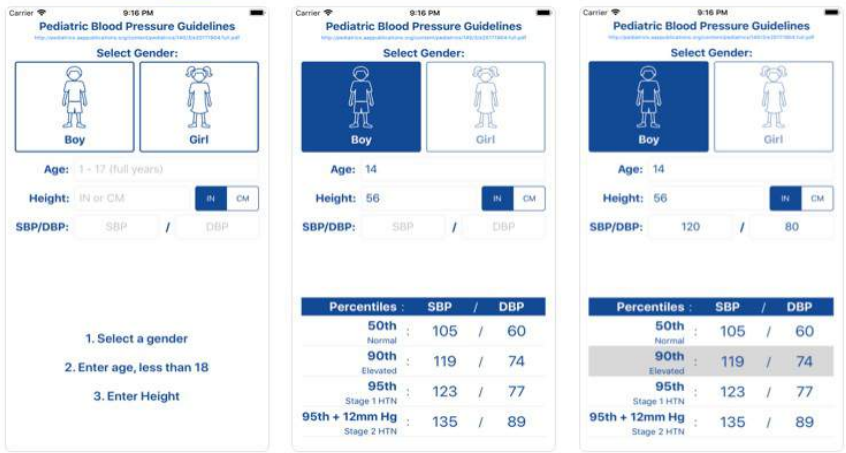
Pediatric Management of HighBP

Arthur Uber

★★★★★ 4.9, 8 Ratings

$0.99

Screenshots iPhone iPad

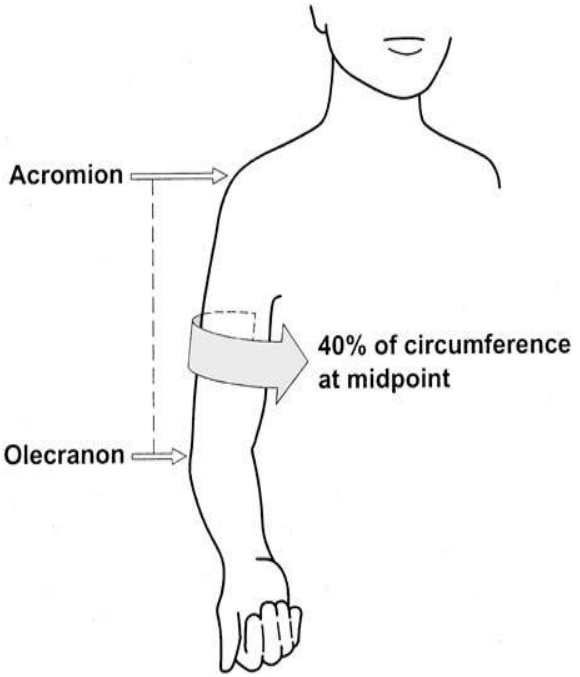


Simple, easy-to-use access to the UPDATED 2017 Pediatric Blood Pressure Guidelines! An essential for all Pediatricians and Subspecialists.

BP measurement

Technique is important!

- Should rest for at least 5 minutes before BP measurement
- Should be sitting in an upright position with back supported and feet uncrossed on the floor, or for younger children, lying down
- Blood pressure readings from the leg usually 10-20 mmHg higher than those from the arm
- The arm should be at heart level and supported
- Cuff should be inflated to 20–30 mmHg above the point at which the radial pulse disappears. Overinflation should be avoided
- Width of the cuff bladder should be at least 40% of the mid-arm circumference and the bladder length should wrap around at least 80%-100% of the upper arm circumference



Factors affecting BP measurement

Factor	Increase in Blood Pressure
Talking	7-10 mmHg
Listening	5 mmHg
Crossed Legs	2-8 mmHg
No back support	6-10 mmHg
Arm unsupported	Systolic:1-7 mmHg; Diastolic: 5-11 mmHg
Arm positioned with center of bladder at heart level	Each inch above this level decreases BP by ≥2 mm Hg, and vice versa*
Oscillometric Device	Systolic:10 mmHg; Diastolic:5 mmHg
Distended urinary bladder	10-15 mmHg
Recent caffeine intake	Systolic:10 mmHg; Diastolic:5 mmHg
Recent smoking	Systolic: 6 mmHg; Diastolic:5 mmHg
Cuff over clothing	Systolic: 5-50 mmHg
Cuff too small	Systolic:10 mmHg; Diastolic:2-8 mmHg

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Proper staging of BPs

- If initial BP elevated (≥90th percentile), providers should perform 2 additional oscillometric or auscultatory BP measurements at same visit and average measurements

- If the averaged oscillometric reading is ≥90th percentile, 2 auscultatory measurements should be taken and averaged to define the BP category

When should BPs be measured?

- BP should be measured annually in children and adolescents ≥3 years of age

- BP should be checked in all children and adolescents ≥3 years of age at every health care encounter if they have

  - obesity
  - history of prematurity
  - taking medications known to increase BP
  - have renal disease
  - history of aortic arch obstruction
  - coarctation of aorta
  - diabetes

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White Coat and Masked HTN

- "White coat hypertension" refers to BPs greater than the 95th percentile in the physician's office and BPs below the 95th percentile outside the physician's office

- Masked hypertension: normal blood pressures in the physician's office and elevated blood pressures outside of the office

- Both white coat and masked hypertension have been linked to increased cardiovascular risk in adults, and masked hypertension has been associated with left ventricular hypertrophy in children

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When to refer patient?

- Patients with persistently elevated BP on 6 month follow up
- Stage 1 and Stage 2 HTN

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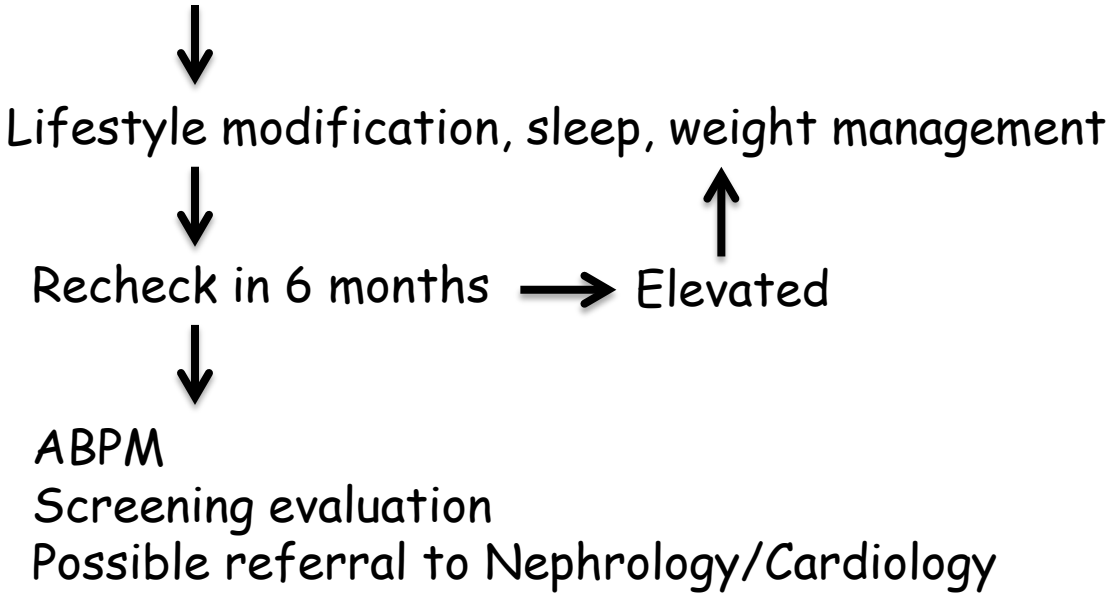
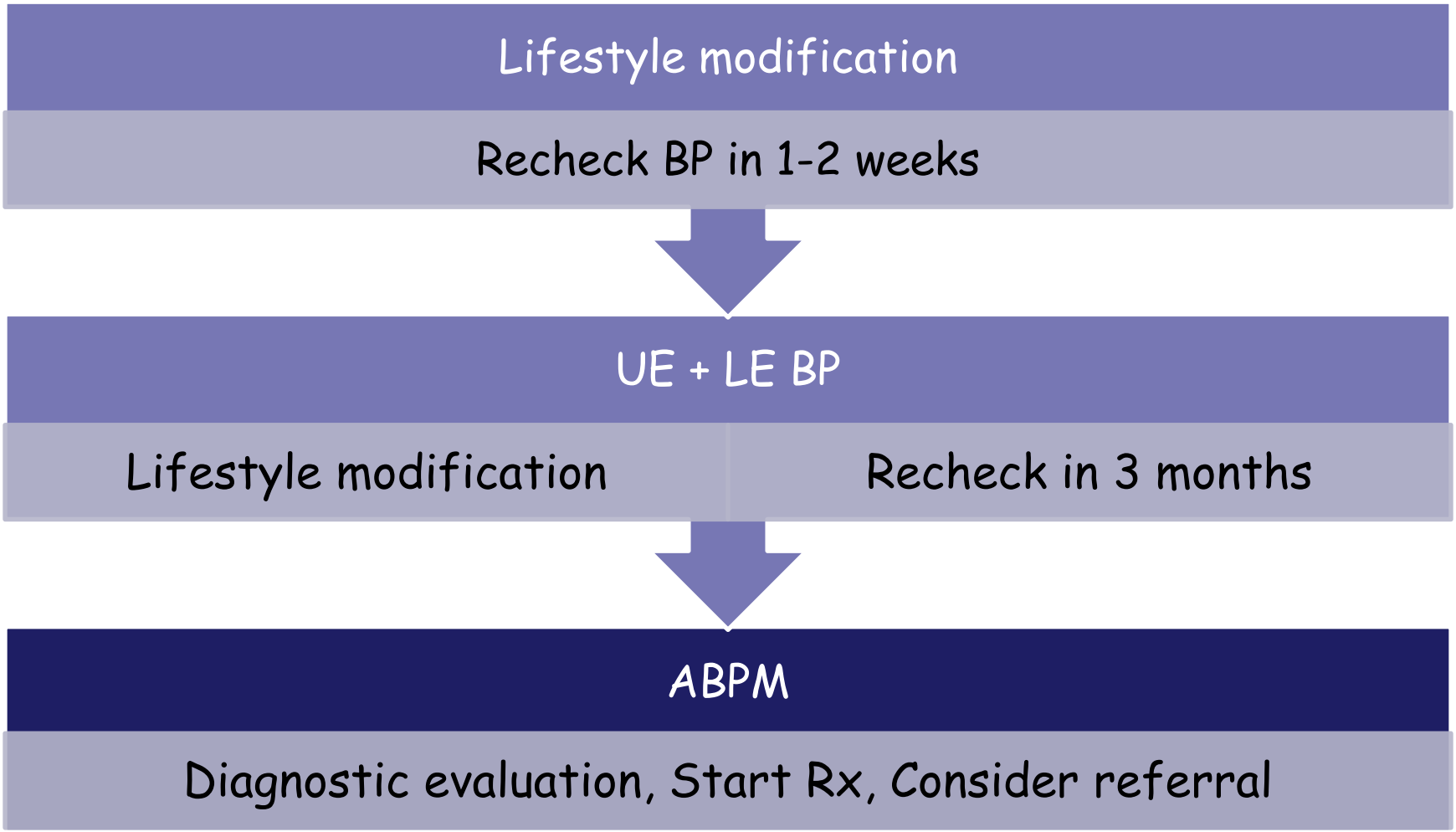
Follow up

- Normal BP → check annually
- Elevated BP



Stage 1 HTN



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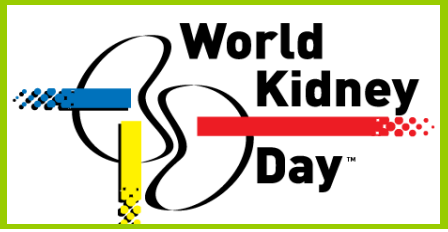
Stage 2 HTN



UE + LE BP, Lifestyle modification

Recheck BP within 1 week or refer

ABPM, diagnostic evaluation, begin Rx

Refer

Anytime patient symptomatic OR >180/120 mmHg

Send to ED immediately

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Clinical Evaluation

History

- Birth History: prematurity, ventilation, umbilical lines
- Illnesses: UTIs, fevers, changes in appearance of urine
- Family History: HTN, MI, renal disease
- Drugs: over the counter (decongestants), prescribed (OCPs, stimulants), illicit
- ROS: headaches, palpitations, flushing, diaphoresis, sweating, chest pain, weakness

Clinical Evaluation

Physical Examination

- Growth curve, BMI
- Unifying syndrome (Cushing, Williams, Turner, etc.)
- Four extremity BPs, HR
- Focused exam
  - Tonsillar hypertrophy
  - Skin manifestations (adenoma sebaceum, café-au-lait spots, malar rash, acne, striae)
  - Abdominal masses and bruits, renomegaly
  - Retinal changes
  - Aberrant sexual characteristics
  - Pulses

Lab Evaluation: Baseline Screening

ALL

- UA
- Electrolytes, BUN, creatinine
- Lipid panel
- RUS if <6 yo, abnormal UA, electrolytes, BUN or creatinine

Obese

- HbA1C
- AST & ALT

PRN

- Fasting blood glucose
- TSH
- Drug screen
- Sleep study
- CBC
- Additional based on clinical suspicion

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Lifestyle Modification

- Weight loss for obesity
  - ~10% decrease in BMI → 8-12 mmHg decrease in BP
- Maintenance of ideal body mass index
- Sodium restriction
  - Adequate Na intake
    - 4-8 yo: 1.2 g/day
    - Older: 1.5 g/day
    - Our recommendations in Hypertension Clinic: < 2 g/day (official recommendations for adults <2.3 g/day)

Lifestyle Modification

- Effect of sodium restriction on blood pressure

He and MacGregor. J Human Hypertension. 2002

- Meta-analysis of randomized trials: effect on blood pressure of modest salt reduction
  - Dose response to salt reduction: 100 mmol ↓ in salt intake → BP ↓ 7/4 mmHg in hypertensive and 4/2 mmHg in normotensive individuals

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Lifestyle Modification

- DASH (Dietary Approach to Stop HTN)
  - Diet rich in fruits and vegetables, fiber
  - Low fat
  - Adequate intake of dietary K, Mg, and Ca
  - The diet reduced SBP by 6 mmHg and DBP by 3 mm Hg in patients with elevated BP
  - Those with hypertension dropped SBP by 11 and DBP by 6 mmHg
  - These changes in blood pressure occurred with no changes in body weight

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Lifestyle Modification

- Exercise

  Alpert BS. Int J Sports Med. 2000.

  - Sustained exercise training over 3-6 months → ↓SBP 6-12 mmHg & ↓DBP 3-5 mmHg
  - Weight loss
  - Cardiovascular benefits

Lifestyle Modification

- Limit alcohol intake
- Smoking cessation
- Yoga
- Meditation

HTN and Sport Participation

- Non-competitive physical activity is encouraged
  - In long term exercise decreases SBP and DBP in those with HTN
  - Adult data: lower all-cause mortality in physically fit patients

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HTN and Sport: AAP Recommendations

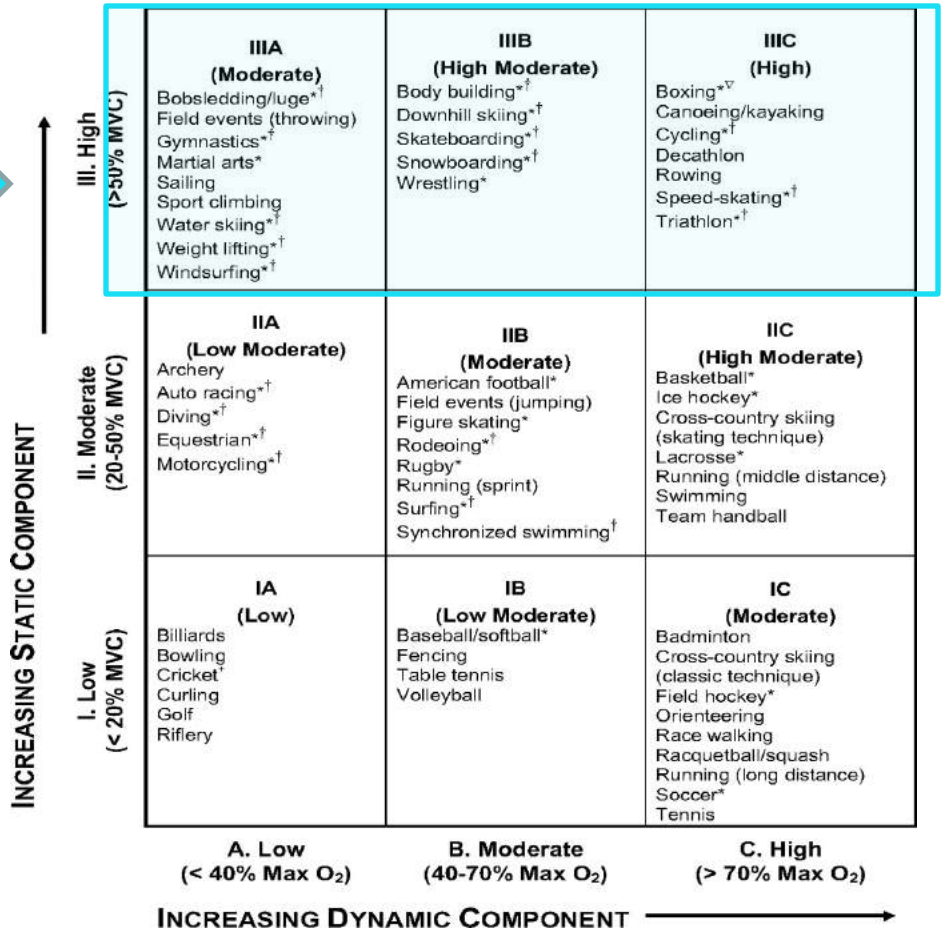
AAP policy statement "Athletic Participation by Children and Adolescents Who Have Systemic Hypertension"

- Pre-HTN: no limitations
- Stage 1 HTN and no end organ damage (LVH, heart disease): No limitations

HTN and Sport: AAP Recommendations

- Stage 2 HTN and no end organ damage (LVH, heart disease)

Restrict high static activities until BP is controlled



Summary

- Ensure BP is accurately measured
- Symptomatic hypertensive patients need prompt evaluation and treatment
- Refer patients with persistently elevated BP, stage 1 and 2 HTN
- Younger patients are more likely to have a secondary cause for hypertension and always need a full work-up
- Use AAP guidelines to guide sports participation

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Questions?

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