HIGH BLOOD PRESSURE IN CHILDREN AND ADOLESCENTS

Pediatric Clinical Learning Day 2017

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PRESENTATION OVERVIEW

• Why focus on High Blood Pressure?
• What do the measurements mean?
• What are we doing about it?
High Blood Pressure is one of the leading causes of death worldwide.
WHY FOCUS ON HIGH BLOOD PRESSURE?

Evidence of end-organ damage in children

- Left ventricular hypertrophy and carotid intima-media thickness changes
- Hyperlipidemia
- Chronic renal failure
- Diabetes
WHY FOCUS ON HIGH BLOOD PRESSURE?

• Mounting evidence that childhood BP correlates with adult BP

• Diagnosis is often missed and is not straightforward
WHAT DO THE MEASUREMENTS MEAN?

Measuring Blood Pressure

• Normal BPs vary by age, sex and height
• Cuff size matters – better too big than too small
## WHAT DO THE MEASUREMENTS MEAN?

<table>
<thead>
<tr>
<th>Age (Year)</th>
<th>BP Percentile</th>
<th>Systolic BP (mmHg)</th>
<th>Diastolic BP (mmHg)</th>
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### Pediatric Blood Pressure Calculator

<table>
<thead>
<tr>
<th>Sex</th>
<th>Male</th>
<th>Female</th>
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</thead>
<tbody>
<tr>
<td>Age</td>
<td>Years</td>
<td>Years / Months / Months</td>
</tr>
<tr>
<td>Height</td>
<td>cm / in</td>
<td>cm / in</td>
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<tr>
<td>BP:</td>
<td>Systolic / Diastolic</td>
<td>mmHg / mmHg</td>
</tr>
<tr>
<td>SBP:</td>
<td></td>
<td>89th percentile</td>
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<tr>
<td>DBP:</td>
<td></td>
<td>91st percentile</td>
</tr>
</tbody>
</table>

- **SBP:** 115 mmHg / 75 mmHg
- **DBP:** 90% BP for age: 115 / 74 mmHg
- **95% BP for age:** 119 / 78 mmHg
- **99% BP for age:** 126 / 86 mmHg

Patient's BP is in prehypertension.

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**WHAT DO THE MEASUREMENTS MEAN?**

<table>
<thead>
<tr>
<th>Male</th>
<th>Female</th>
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</thead>
<tbody>
<tr>
<td>Age (year, 2 to 17)</td>
<td>13</td>
</tr>
<tr>
<td>Height (centimeters)</td>
<td>160</td>
</tr>
<tr>
<td>Systolic BP (mmHg)</td>
<td>122</td>
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<tr>
<td>Diastolic BP (mmHg)</td>
<td>73</td>
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</tbody>
</table>

**Systolic:**
- Normal: 90th% to 99th%
- Prehypertension: 90th% to <99th%
- Stage 1 Hypertension: 99th% to <99th%
- Recheck in 1-2 weeks, or sooner

**Diastolic:**
- Normal: <90th%
- Prehypertension: 90th% to <99th%
- Recheck in 6 months
Defining High Blood Pressure

- Pre-HB: 90th to 95th percentile or >120/80
- Stage 1 HB: 95th to 99th percentile +5 mm Hg
- Stage 2 HB: >99th percentile +5 mm Hg
- Based on three readings on separate visits
- Ambulatory BP monitoring is helpful
WHAT DO THE MEASUREMENTS MEAN?

Risk factors for High Blood Pressure

- Overweight, obesity
- Family history of High BP, CVD
- Male sex
- Maternal smoking during pregnancy (breast feeding reduces this risk)
Primary or secondary High Blood Pressure?

- Secondary High BP is more common in younger children and Stage 2 High BP
WHAT DO THE MEASUREMENTS MEAN?

Secondary High Blood Pressure

• Yes, it is more common
• Yes, renal causes most common (34%)
• Pulmonary causes also common (20%)
Some secondary causes and findings

- Coarctation of aorta
- Cushing Syndrome
- Drug effect
- Pheochromocytoma
WHAT DO THE MEASUREMENTS MEAN?

More secondary causes

• Hyperthyroidism
• Obstructive sleep apnea
• Rheumatological disease
And finally...renal causes

- Renal artery stenosis
- Renal parenchymal disease
Evaluation of High Blood Pressure

- All: BUN/Cr. CBC, electrolytes, fasting glucose, lipid profile
- Targeted evaluation
  - Echocardiography
  - Retinal analysis
  - Renal ultrasound
  - Angiography, Digital Subtraction Angiography

WHAT ARE WE DOING ABOUT IT?
WHAT ARE WE DOING ABOUT IT?

Treatment goals

- Decrease to <95th percentile if no end-organ damage
- Decrease to < 90th percentile if damage present

*Expert opinion, extrapolated from adult studies
WHAT ARE WE DOING ABOUT IT?

Treatment

- New lifestyle and weight management care pathway
WHAT ARE WE DOING ABOUT IT?

Medication Treatment

- Symptomatic High BP
- Secondary High BP or end-organ damage
- No studies yet on long-term outcomes
- Short-term studies are of varying quality
WHAT ARE WE DOING ABOUT IT?

International Childhood Cardiovascular Cohort (i3C)

• Seven large cohorts in the US, Finland, Australia followed since 2002
• An effort to link childhood cardiovascular risks to adult disease
• Closes in 2018
Medication choices

- ACE inhibitors, calcium channel blockers preferred by a group of surveyed nephrologists
- Candesartan, Lorsartan
- Diuretics, β-blockers
- Safe and well tolerated
- Have been shown to reverse progression of end organ damage
WHAT ARE WE DOING ABOUT IT?

Medication choice depends on associated condition

- ACE inhibitor for proteinuric renal disease
- Avoid β-blocker in athletes (prohibited in some events)
Current recommendation is for nephrologists to manage meds

- Will this be possible if our increased screening is effective?
WHAT ARE WE DOING ABOUT IT?

VRP goals

• Increase awareness
• Increase measurement and improve accuracy of BP
• Educate about diagnosis and management
WHAT ARE WE DOING ABOUT IT?

2017 VRP

- Measure BP in 20% of patients 12 – 18 years old (all visits) from January – June 2017
- Measure BP in 60% of patients from July – December 2017
- Attend Clinical Learning Day on High BP
- Develop a tool in iCentra to compare BPs to normal ranges for the patient variables
- Document PAVS in 20% of unique adolescent patients by June 30, and 40% by December 31.
THE FUTURE

• Diagnose and treat High Blood Pressure
• Determine outcomes and share our findings to improve care for more patients
• Get started — 40 years is long enough!