Pediatric Hypertension Management

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2017 AAP Guidelines: What’s Hypertension?

Measure BP properly

- **Bad patient prep:**
  - Cold office (↑)
  - Nicotine/caffeine ingestion <30 min (↑)
  - Full bladder (↑)

- **Bad patient positioning:**
  - Constrictive clothing/unbared arm (↑)
  - Moving/talking (↑)
  - Unsupported arm/unsupported back/unsupported feet (↑)
  - Arm not at level of right atrium:
    - Arm lower: ↑
    - Arm higher: ↓

  Plz no ->

<- wrong

<- never do this
Measure BP properly

• **Bad cuff size:**
  • Cuff bladder width should be 40%+ of the circumference of the middle of the upper arm
  • Cuff bladder length should be 80%+ of the circumference of the middle of the upper arm
  • Cuff too big: ↓
  • Cuff too small: ↑

<table>
<thead>
<tr>
<th>cuff size (cm)</th>
<th>name</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 x 8</td>
<td>newborn</td>
</tr>
<tr>
<td>6 x 12</td>
<td>infant</td>
</tr>
<tr>
<td>9 x 18</td>
<td>child</td>
</tr>
<tr>
<td>12 x 22</td>
<td>small adult</td>
</tr>
<tr>
<td>16 x 30</td>
<td>adult</td>
</tr>
<tr>
<td>16 x 36</td>
<td>large adult</td>
</tr>
<tr>
<td>16 x 42</td>
<td>extra-large adult</td>
</tr>
</tbody>
</table>

• **Bad measurement:**
  • Manual: Letting pressure out too quickly (↓ PP)
  • Oscillometric: Not rechecking high BP manually

• **Bad machine:**
  • Uncalibrated aneroid sphygmomanometer
## New guidelines: dx of hypertension

If BP >90th, repeat 2x and average. If average is not in normal range:

<table>
<thead>
<tr>
<th>If average is...</th>
<th>Actions</th>
<th>If still at this level at first F/U visit:</th>
<th>If still at this level at second F/U visit:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elevated BP (≥90th)</td>
<td>Lifestyle counseling, +/- nutrition referral; recheck in 6 mo.</td>
<td>Check 4 ext BP, repeat lifestyle counseling, see back in 6 more months</td>
<td>ABPM to confirm, screening labs, +/- specialist</td>
</tr>
<tr>
<td>Stage 1 htn (≥95th)</td>
<td>Lifestyle counseling, +/- nutrition referral; recheck 1-2 weeks.</td>
<td>Check 4 ext BP, repeat lifestyle counseling, see back in 3 more months</td>
<td>ABPM to confirm, screening labs, +/- specialist, treat.</td>
</tr>
<tr>
<td>Stage 2 htn (≥95th + 12)**</td>
<td>Lifestyle counseling, check 4 ext BP, recheck &lt;1 week OR send to specialist &lt;1 week</td>
<td>ABPM to confirm, screening labs, and treatment, OR send to specialist &lt;1 week</td>
<td>**If &gt;95th + 30 mmHg OR 180/120 OR Stage 2 &amp; symptomatic, to ER</td>
</tr>
</tbody>
</table>

If ≥95th on 3 different visits -> diagnose hypertension

## The role of ABPM in kids

BP is not static!

- Useful to distinguish HTN vs white coat hypertension (30-50% of elevated pediatric BP)
  - Cost-saving if done prior to labs, echo, referral, Rx
  - Cost-saving if done in PCP office ($1265 at children's hospital!)
- Useful to identify masked hypertension (obesity, coarc repair)
- Only reliable way to look for nocturnal dipping vs. non-dipping
- Use in evaluation of moderate to severe OSA (even after AT)
- Good for data when deciding on med changes
Screening Tests: Look for 2ary htn causes

- For all:
  - Urinalysis
  - BMP
  - Lipid panel
  - If <6 yo or abnormal U/A, renal function

- If obese, also:
  - HbA1c
  - AST/ALT

- Depending on patient:
  - Fasting glucose
  - TSH
  - Drug screen
  - Sleep study
  - CBC

Verdict on other studies:

- Echocardiogram – do when starting meds
- Renal ultrasound, CTA, MRA – consult with specialist
- EKG – not useful as screening for LVH
- Nuclear renography – not useful
- Serum uric acid – not useful
- Microalbuminuria – not useful in kids

How do I pick an ABPM machine?

AAP Guideline recommends:

- Dabl Educational table of validated devices

Also consider:

- British & Irish Hypertension Society ABPM page (https://bihsoc.org/bp-monitors/for-specialist-use/)
- See what authors use in pediatric ABPM studies
- Ask your favorite peds nephrologist/cardiologist

BE SURE YOUR CHOICE HAS A WAY TO INTERPRET PEDIATRIC STUDIES
ABPM in kids: How does it work?

Helpful Tips:
1. Keep your arm still when the device starts-moving your arm will give an error
2. Press the event button- Press this button if you are participating in an extra-curricular activity (i.e. Baseball, Soccer, Football, etc.) or if you are experiencing anxiety (i.e. taking a test)
3. Press the day/night button- once you go to bed and when you wake up; however, if you forget, it's ok, readings will still occur.

More Helpful Tips:
1. Do not take a bath, shower or go swimming with the device on.
2. Do not turn off the device at any time.
3. Do not take the device unless you are experiencing pain, swelling, redness or numbness on the arm where the cuff is placed, or unless directed to do so by your provider.
4. Do not go to the ER if you get an error message or a high reading.
5. Do not remove batteries at anytime.
ABPM results

1) Machine gives log
2) Discard outlier measurements
3) Assess adequacy
4) Compute:
   • Mean SBP & DBP for total, day, and night
   • BP load for SBP & DBP (load = % of readings above >95th %ile)
   • Dipping (percent day/night difference)

ABPM Interpretation

Compare computed values to tables of ABPM age/height/sex-based norms:
Hypertension treatment

- Goal: reduce SBP and DBP to <90th %ile (<130/80 in adolescents)
  (No sports clearance until end organ risk assessed & no Stage 2 HTN)

- Start meds for:
  - Patient has failed >6 months of lifestyle change
  - Symptomatic hypertension
  - Stage 2 hypertension

- Follow up:
  - Lifestyle change only: q 3-6 months
  - Meds: q 4-6 weeks for dose adjustments until goal reached then q 3-4 months
Choice of meds

• Lisinopril:
  • Initial dose 0.07 mg/kg/day (max 5 mg)
  • Titrate upwards as high as 0.6 mg/kg/day (max 40 mg) divided daily
  • Liquid (1 mg/ml) and tabs (2.5 mg, 5 mg, 10 mg, 20 mg, 30 mg, 40 mg)
  • $5-10 cash for 1 month supply of tabs

• Losartan:
  • Initial dose: 0.7 mg/kg/day (max 50 mg)
  • Titrate upwards as high as 1.4 mg/kg (max 100 mg)
  • Liquid (2.5 mg/ml compounded) and tabs (25 mg, 50 mg, 100 mg)
  • $15-30 cash for 1 month supply of tabs

• Hydrochlorothiazide:
  • Initial dose: 1 mg/kg/day (max 25 mg)
  • Titrate upwards as high as 3 mg/kg/day (max 50 mg) divided daily or BID
  • Tabs (12.5, 25, 50 mg)
  • $5-10 cash for 1 month supply of tabs

Approach to HTN QI in general pediatrics

Population-based:
• Who’s had their BP checked at a well visit? (67-84%, 2012)
• Who’s had their BP checked at other recommended intervals? (35%, 2012)
• Who’s had elevated BPs?
• Were elevated BPs noted by the physician? (13%, 2010)
• Who’s had elevated BP rechecks on schedule?
• Who’s had 3 elevated BP and had their chart marked? (26%, 2007)
• Who’s had appropriate screening/ABPM/treatment instituted?

Risk-based:
• Do I have the charts marked for all kids who are high-risk for HTN?
• When did these kids last have casual BP/ABPM assessed?
ROI

• 99211 for placement & nurse teaching
  • National Medicare fee (2020): $23.46
• 93784 for recording, upload, interpretation, report
  • National Medicare fee (2020): $47.28 (wRVU 0.38)

Cost of machine: $1500-$3000 (including cuffs and software)

Cost of staff to set up each patient: $10 - $15

Cost of physician interpretation: $14 (wRVU @ $36 or 3.5 min @ $250/hr)

Less cost of end-to-end referral tracking: $2-7

Revenue $71, cost-per $26-36; net-per $35-45, machine pays for itself after 33-85 uses

References

Pediatric Chronic Disease References

- **ADHD**: [https://www.cdc.gov/ncbddd/adhd/data.html](https://www.cdc.gov/ncbddd/adhd/data.html)

QI References