Techniques of Vital Signs

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Objectives

- Define “normal” in several ways.
- Describe correct technique of measuring vital signs.
- Describe correct technique for evaluating pulses.
- Know that different populations may have different normal values.
What Does “Normal” Mean?

- **Average**
  - Population (sample) mean
- “Healthy” - appropriate physiologic function
- These two definitions can be incompatible
What Does “Normal” Mean?
Average Blood Pressure, by Age

Blood Pressure, mm Hg

Kannel, Bull NY Acad Med, 54(6), 1978
Risk of CV Disease Increases With SBP

Framingham study
Temperature

- Oral
- Rectal
  - Often used in infants, continuous monitoring for severe hypothermia/hyperthermia
- Axillary
  - Poor correlation with rectal temperature
  - Don’t use if accurate temperature important
    - neonates may be exception

BMJ 320(29), April 2000
Tympanic Temperature

- Measures core temperature
- Caution point
  - Point at TM
  - No wax
Temperature - Normal Values

- **Oral** - 37°C (98.6°F), Fever > 38°C (100.4°F) (wunderlich)
- **Oral** - 36.8°C (98.2°F), Fever > 37.3°C (99.9°F) (JAMA, 269:1578-80)
- **Rectal** 0.4°C to 0.5°C (0.7°F to 0.8°F) higher than oral
- **Tympanic** 0.8°C (1.4°F) higher than oral
Respiratory Rate

- Respiratory cycles per minute
- Observe rise and fall of chest
- Depth, effort of breathing, rhythm
  - Accessory muscle use, retractions, nasal flaring
- For infants
  - observe abdomen
  - count for 60 seconds, or two thirty second intervals
Pulse

- Number of cardiac cycles per minute

- Pulse affected by:
  - Volume of blood ejected (stroke volume)
  - Distensibility of aorta and large arteries
  - Viscosity of blood
  - Rate of cardiac emptying
  - Peripheral arteriolar resistance
Palpation of Pulses

- Pads of second and third fingers
  - Gentle pressure
- Assess:
  - Rate (15 or 30 seconds, multiply by 4 or 2)
  - Rhythm (regular, irregular, irregularly irregular)
  - Amplitude
  - Contour (upstroke, peak, descending)
Brachial Pulse
Femoral Pulse
Popliteal Pulse
Dorsalis Pedis (DP) Pulse
Posterior Tibialis (PT) Pulse
Describing Pulses

- Rate and rhythm
- Amplitude
  - 0 - absent
  - 1+ - decreased
  - 2+ - normal
  - 3+ - increased
  - 4+ - bounding
- Contour
Abnormal Pulses

- Large, bounding pulse
- Alternating pulse (pulsus alternans)
- Water-hammer pulse
Measurement of Blood Pressure

- Choose correct size cuff
- Place cuff on limb (usually arm)
- Measure palpable systolic blood pressure
- Measure blood pressure
- Record the blood pressure
Choose an Appropriately Sized Blood Pressure Cuff

- Bladder width ~ 40% of limb circumference, length ~ 80% of limb circumference.
- Too large cuff underestimates blood pressure.
- Too small cuff overestimates blood pressure.
Place the Blood Pressure Cuff on the Limb

- Don’t use arm with arteriovenous fistula or on side of radical mastectomy
- No clothing on upper arm, or very light sleeve.
- On arm, lower edge of cuff 2 to 3 cm above antecubital fossa
- Place cuff snugly about the limb.
- Center bladder over brachial artery
Measure the Palpable Systolic Blood Pressure

- Support patient’s arm, at heart level.
- Palpate radial artery, rapidly pump up cuff until pulse no longer palpable.
- Pump up cuff another 20 mm hg.
- Release pressure at 2 to 3 mm hg per second, until pulse is felt.
- Rapidly release pressure from cuff.
  - Wait 30 seconds
Measure the Blood Pressure

- Bell of stethoscope over artery
- Rapidly pump up cuff to 20 - 30 mm hg over palpable systolic blood pressure.
- Release pressure in cuff at 2 to 3 mm hg per second, listen for Korotkoff sounds.
- Record BP as systolic/diastolic (120/80)
- Repeat in other arm. Take higher reading as patient’s blood pressure.
Korotkoff Phases of BP

<table>
<thead>
<tr>
<th>Systolic</th>
<th>Auscultatory gap</th>
<th>First diastolic</th>
<th>Second diastolic</th>
</tr>
</thead>
<tbody>
<tr>
<td>mm Hg 120</td>
<td>110</td>
<td>100</td>
<td>90</td>
</tr>
<tr>
<td></td>
<td></td>
<td>80</td>
<td>mm Hg</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sharp “thud”</th>
<th>Blowing or swishing sound</th>
<th>Softer thud than phase 1, still crisp</th>
<th>Softer blowing sound that disappears</th>
<th>Silence</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHASE 1</td>
<td>PHASE 2</td>
<td>PHASE 3</td>
<td>PHASE 4</td>
<td>PHASE 5</td>
</tr>
</tbody>
</table>
Important Considerations in BP Measurement

- Sphygmomanometer dial/column should be at eye level.
- Patient seated, back supported and feet on the floor
- Patient at rest for 5 minutes
- Pt. Refrain from caffeine or nicotine
  - JAMA, 273; pp 1211-1218, 1995
Pitfalls in blood pressure measurement

- Arrhythmias
- Venous congestion
- Korotkoff sounds do not disappear
Does This Patient Have Hypertension?

- Diagnosis should be based on average of two or three readings
  - Individual variation in blood pressure
  - Regression to the mean
  - Especially in patients near diagnostic cut point
# JNC VI BP Classification

<table>
<thead>
<tr>
<th>Category</th>
<th>Systolic</th>
<th>Diastolic</th>
<th>Follow-up</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optimal</td>
<td>&lt;120 and</td>
<td>&lt;80</td>
<td>2 years</td>
</tr>
<tr>
<td>Normal</td>
<td>&lt;130 and</td>
<td>&lt;85</td>
<td>2 years</td>
</tr>
<tr>
<td>High</td>
<td>130-139 or 85-89</td>
<td>1 year</td>
<td></td>
</tr>
<tr>
<td>Normal</td>
<td>140-159 or 90-99</td>
<td>2 months</td>
<td></td>
</tr>
<tr>
<td>Stage 1</td>
<td>160-179 or 100-109</td>
<td>1 month</td>
<td></td>
</tr>
<tr>
<td>Stage 2</td>
<td>≥180 or ≥110</td>
<td>1 wk</td>
<td></td>
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<tr>
<td>Stage 3</td>
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</tbody>
</table>
Does the patient have hypovolemia?

- Measure pulse and blood pressure in supine and standing position
  - **Supine** - wait 1 minute
  - **Standing** - wait 2 minutes
- **Pulse increase ≥ 30 bpm**
- **Unable to stand for VS measurement**

*JAMA, 281 (11); 1022-1029*