Vital Signs

Chapter 12

- Body Temperature
- Pulse Rate
- Respiratory Rate
- Blood Pressure
- Pain* (Chapter 20)

This objective data is used to indicate changes in body function.

Body Temperature

The warmth of the human body

- **Shell Temperature** ~ warmth at skin surface
- **Core Temperature** ~ warmth in deeper sites within the body – (brain, heart)
- **Body heat** is produced from exercise and metabolism of food
- **Body heat** is lost through the skin, lungs, and body’s waste products.

— See Table 12-1, pg. 185
Temperature Measurement

- Study of Thermokinetics (heat in motion) led to measurement scales we use today
- Various scales include:
  - (K) Kelvin
  - (R) Rankine
  - (F) Fahrenheit
  - (C) Centigrade or Celsius

Temperature Measurement

- The Fahrenheit scale (F) is used in the US to measure body temp
  - 32° F is the temp in which water freezes
  - 212° F is the temp in which water boils
- The Centigrade scale (C) is used in scientific research and in countries that use the metric system
  - 0° C is the temp in which water freezes
  - 100° C is the temp in which water boils

Temperature Conversion Formulas*

- To convert Fahrenheit to Centigrade use
  \[ C° = \frac{( F° - 32)}{1.8} \]
- To convert Centigrade to Fahrenheit use
  \[ F° = ( C° \times 1.8) + 32 \]
- See Box 12-2, pg. 186
- Nurses often use both scales and convert between the two

Normal Body Temperature*

- **Shell Temperature** ~ *
  - 96.6 to 99.3 F°
  - 35.8 to 37.4 C°
- **Core Temperature** ~
  - 97.5 to 100.4 F°
  - 36.4 to 37.3 C°
Temperature Regulation

- The Hypothalamus
  - A structure within the brain that helps control various metabolic activities
  - Acts as the center for temperature regulation
    - The anterior Hypothalamus promotes heat loss through vasodilatation and sweating
    - The posterior Hypothalamus promotes:
      - Heat conservation
      - Heat production

Temperature Regulation by the Hypothalamus continued:

- Maintains the core temperature (set point) to within 1°C
- See Figure 12-1, pg 186
- Temp above 105.8°F and below 93.2°F
  - Indicates impairment of the hypothalamus
- Temp above 110°F and below 84°F
  - The chance for survival is diminished

Factors Affecting Body Temp

- Food Intake ~ Thermogenesis
- Age ~ Metabolic Rate
- Climate
- Gender
- Exercise and activity
- Circadian Rhythm
- Emotions
- Illness or Injury
- Medications
- Food Intake
Assessment Sites

- Core Body Temperature ~ Most Accurate
  - Brain – no technology
  - Heart, lower third of esophagus and urinary bladder—use thermistor catheter.
  - Most convenient and practical sites include the mouth, rectum, axilla and ear

Practical and Convenient Assessment Sites

- Oral
- Rectal
- Axillary
- Ear

Oral Site

- Considered a shell temp
- Measures 0.8° to 1.0°F below the core temp
- Place the oral thermometer
  - Under the tongue
  - In direct proximity to the sublingual artery
  - Sublingual pocket—See fig 12-3, page 188
  - Poor placement or premature removal can lead to an inaccurate reading

Oral temperature measurement
Oral Site*

- Oral Site is contraindicated in:
  - Uncooperative
  - Very young
  - Unconscious
  - Shivering
  - Prone to seizures
  - Mouth breathers
  - Those who have had oral surgery
  - Talking while taking the temp

Oral Site

- To ensure accuracy, delay oral temp assessment for 30min after:
  - Chewing gum
  - Smoking cigarette
  - Eating or drinking hot or cold food or beverages

Rectal Site*

- The rectal temp differs only about 0.2°F from the core
- In adult insert 1.5 inch, 1 inch in child and 0.5 inch in infant
- Accuracy may be affected by
  - Stool in the rectum
  - Improper placement
  - Premature removal
- This site may be embarrassing and emotionally traumatic for alert pt

Axillary Site

- The axilla (underarm) ~ Shell temp
- 1°F lower than the oral site
- Advantages
  - Safe for all ages and readily accessible
  - Decreased potential for spreading microbes
  - Less traumatic than rectal site
- Disadvantages
  - Assessment time 5 Minutes
  - Affected by poor circulation, bathing and rubbing axilla with dry towel
The Ear

- Temp within the ear near the Tympanic membrane
- Closest to the core temp
- 1.4 inches from the hypothalamus
- Blood from internal and external carotid arteries warms the tympanic membrane
- When inserted correctly it is the most reliable

Ear Temperatures

![Diagram of ear showing probe insertion]

Thermometers

- Glass- obsolete
- Electronic
- Infrared Tympanic thermometers
- Chemical
- Digital
- Automated
- Continuous

Electronic Thermometers

- Uses a temperature sensitive probe
- Oral, axillary or rectal
- Predictive or monitor mode
- Fast, convenient and most sanitary
Infrared (Tympanic) Thermometers

- Probe contains infrared sensor
- Detects warmth from tympanic membrane
- Convert heat to a temp in 2-5 seconds
- Will produce inaccurate measurements if
  - Ear canal is not straightened
  - The probe is too large for ear canal (6-8mm)
  - Directed at the ear canal not the tympanic membrane
  - Impacted with cerumen (ear wax)
  - There is fluid behind the tympanic membrane
  - The drawdown effect (cooling on contact)

Other Thermometers

- Chemical Thermometers - heat sensitive tape or chemical dot thermometers (Isolation)
- Digital Thermometers – includes a sensing tip at the end, on/off button and display area
- Automated Monitoring Devices – save time and money
- Continuous Monitoring Devices - internal thermistor probes used in ICU and are used only in acute patients.

Elevated Body Temperature*

- Fever ~ Body temp over 99.3
- Pyrexia ~ (Greek work for fire) warmer than normal set point
- Febrile ~ condition in which temp is elevated
- Afebrile ~ condition in which there is no fever*
- Hyperthermia ~ excessively high core temp over 105.8 F
  - Increased metabolic demands
  - Will lead to Brain damage or death

Signs and Symptoms associated with Fever*

- Pinkish, red (flushed) skin
- Restlessness or sleepiness
- Irritability, headache
- Poor appetite
- Glassy eyes and sensitivity to light
- Increased pulse, respiration or perspiration
- Disorientation and confusion
- Convulsions (in small children)
- Fever Blister in clients with HSV
Phases of a Fever

- **Prodromal phase**
  - Nonspecific symptoms just before fever
- **Onset or invasion phase**
  - Mechanism for increased temp ~ shiver, pale, or feel cold
- **Stationary phase**
  - Fever is sustained
- **Resolution or Defervescence phase**
  - Fever returns to normal

Nursing Management

- Fever is an important defense mechanism against microorganisms
- Fever below 102°F with no chronic medical condition
  - Provide fluids and rest
- Fever 102°F to 104°F
  - Antipyretics ~ Drugs that reduce fever
    - Tylenol or Aspirin
- Fever between 104-105.8°F
  - Cooling blanket and other physical cooling measures

Subnormal Body Temperature

- Hypothermia ~ core body temp, less than 95°F
  - Mild - 95-93.2°F
  - Moderate - 93-86°F
  - Severe - below 86°F (Fatal)
- Cold body temps are best be measured with tympanic thermometers
- See guidelines 12-2, pg 194

Subnormal Body Temperature

- Signs and Symptoms
  - Shivering
  - Pale, cool and puffy skin
  - Impaired muscle coordination
  - Listlessness
  - Decreased pulse, respirations
  - Irregular Heart rate
  - Impaired ability to think and use good judgment
  - Impaired ability to feel pain
Pulse *

- A wavelike sensation that can be palpated in a peripheral artery
  - The **pulse rate** — the number of peripheral pulsations in one minute
    - Normal 60-100 BPM at rest
  - Tachycardia ~ a fast heart rate
    - 100-150 at rest
  - Palpitation ~ awareness of your own HR
  - Bradycardia ~ Slow heart rate (less than 60 BPM)

Factors Affecting Pulse and HR

- Age
- Circadian rhythm
- Gender
- Body build
- Exercise and activity
- Stress and emotion
- Body temperature
- Blood volume
- Drugs

Pulse Rhythm & Volume

- **Pulse Rhythm** ~ Pattern of the pulsations and the pauses between them. It is normally regular.
  - Arrhythmia or dysrhythmia ~ irregular pattern
- **Pulse volume** ~ quality of the pulse related to the force of the heart's contraction
  - Thready ~ not easily felt, slight pressure (disappears)
  - Weak ~ stronger than thready, light pressure (disappears)
  - Normal ~ easily felt, moderate pressure (disappears)
  - Bounding ~ strong will not disappear with pressure
  - See Table 12-6, pg 196-Identifying Pulse Volume

Assessment Site

- The arteries used for pulse assessment lie close to the skin ~ **peripheral pulses**
- Most named for the bone it’s located near
- The radial artery (inner aspects of wrist – thumb side) is used most for pulse assessment
- Other techniques include
  - Apical heart rate
  - Apical radial rate
  - Doppler Ultrasound
Carotid pulse site

Radial Pulse site

Brachial Pulse site

Apical Pulse Site

- ***Apical pulse – Learning Activity
  Show Examples!!
Peripheral Pulse sites*

- Temporal
- Carotid
- Brachial
- Radial
- Femoral
- Popliteal
- Posterior tibial
- Dorsalis pedis

**Figure 11-12 Peripheral pulse sites.**

**Apical Heart Rate**

- The number of ventricular contractions per minute ~ assessed by listening slightly below the left nipple, in line with left clavicle
  - More accurate than radial pulse
  - Is counted by listening with a stethoscope
  - Or by feeling at the point of maximum impulse
  - At the apex or lower tip of the heart
  - Listen for the lub/dub sound
Apical-Radial Rate

• The number of sounds heard at the heart’s apex and the rate of the radial pulse during the same period
  – Counted by two different nurses
• Pulse deficit: difference between the apical and radial pulse rates
• See figure 12-13, pg 197

Examples of Pulse Patterns

Doppler Ultrasound Device

• Doppler ultrasound device is an electronic instrument that detects the movement of blood through peripheral blood vessels and converts the movement to a sound

Respiration*

• Respiration ~ is the exchange of oxygen and carbon dioxide
• Ventilation ~ movement of air in and out of the chest ~ counts as 1 respiration (inhale + exhale = 1 respiration)
• The Respiratory Center of the brain is the Medulla
  – Controls Ventilation
  – Monitors carbon dioxide
Respiratory rate

- **Respiratory rate** ~ number of ventilations per minute
  - Table 12-7, pg 197
  - Average adult normal range ~ 14 – 20 per minute
- **Tachypnea** ~ rapid respiratory rate
- **Bradypnea** ~ slow respiratory rate

Breathing Patterns *

- **Hyperventilation** ~ rapid and/or deep breathing
- **Hypoventilation** ~ diminished breathing
- **Dyspnea** ~ difficult and/or labored breathing
- **Orthopnea** ~ breathing facilitated by sitting up
- **Apnea** ~ absence of breathing
- **Stertorous breathing** ~ noisy ventilation
- **Stridor** ~ harsh, high-pitched sound on inspiration/obstruction

Blood Pressure

- Blood Pressure is the force that the blood exerts within the arteries
- Several physiologic variables
  - Circulating blood volume
  - Contractility of the heart
    - Preload
  - Cardiac Output
  - Blood viscosity
  - Peripheral resistance
    - Afterload

Blood Pressure

- Measuring blood pressure helps to assess the efficiency of the circulatory system
- Blood Pressure reflects:
  - The ability of the arteries to stretch
  - Volume of the circulating blood
  - The amount of resistance the heart must overcome when it pumps blood
Factors affecting Blood Pressure

- Age
- Circadian Rhythm
- Gender
- Exercise and activity
- Emotions and pain
- Miscellaneous factors

Pressure Measurements **

- **Systolic Pressure** ~ pressure within the arterial system when the heart contracts (Top number)
- **Diastolic Pressure** ~ pressures within the arterial system when the heart relaxes and fills with blood (Bottom number)
- **Pulse Pressure** ~ difference between the systolic and diastolic blood pressure
- A rise or fall of 20-30 mmHg in usual pressure is significant even if it is within normal range

Assessment Sites

- Most common site is over the brachial artery at the inner aspect of the elbow
- Alternative sites are needed for clients with:
  - No arms
  - Both breasts removed
  - Vascular surgery
  - Dressing or cast obscuring both arms
  - In above situations measure BP over the popliteal artery behind the knee (See how to take a thigh blood pressure on page 204 and skill 12-5, page 224)
Equipment for measuring B/P

- Sphygmomanometer
  - Mercury Manometer (Old one used)
  - Aneroid Manometer
  - Electronic Manometer
- Inflatable Cuff
- Stethoscope

Measuring Blood Pressure*

- Korotkoff Sounds
  - Phase I ~ First faint tapping sounds
  - Phase II ~ Swishing sound
  - Phase III ~ Loud and crisp sounds
  - Phase IV ~ Muffled sounds
  - Phase V ~ One sound follow by silence
- When measuring Blood Pressure
  - Systolic = 1st of a regular series of beats (Phase I)
  - Diastolic = Last sound heard (Phase V)

Alternative Assessment of B/P

- Palpating the blood pressure
- Doppler Stethoscope
- Automatic blood pressure Monitoring
- Measuring Thigh Blood Pressure
Abnormal B/P Measurements

- **Hypertension** ~ high blood pressure
- **White coat Hypertension** ~ High B/P when taken by health care worker otherwise normal
- See table 12-11, page 205 for BP measurements
- KNOW NORMAL VALUE
- Hypertensive blood pressures are associated with:
  - Anxiety
  - Obesity
  - Vascular Disease
  - Stroke
  - Heart failure
  - Kidney disease

<table>
<thead>
<tr>
<th>Categories for Blood Pressure Levels in Adults*</th>
<th>(In mmHg, millimeters of mercury)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Category</td>
<td>Systolic (Top number)</td>
</tr>
<tr>
<td>Normal</td>
<td>Less than 120</td>
</tr>
<tr>
<td>Prehypertension</td>
<td>120-139</td>
</tr>
<tr>
<td>High Blood Pressure</td>
<td></td>
</tr>
<tr>
<td>Stage 1</td>
<td>140-159</td>
</tr>
<tr>
<td>Stage 2</td>
<td>160 or higher</td>
</tr>
</tbody>
</table>

* For adults 18 and older who:
  - Are not on medicine for high blood pressure
  - Are not having a short-term serious illness
  - Do not have other conditions such as diabetes and kidney disease

Abnormal B/P Measurements continued:

- **Hypotension** ~ low blood pressure
- **Postural** or **orthostatic hypotension** ~ sudden drop in blood pressure when rising from a reclining position

Documenting Vital Signs

- See figure 12-21, pg 206
- Vital signs are documented as data in the graphic recording and or nursing notes
Nursing Implications

- Vital signs assessment can assist in identifying these nursing diagnoses:
  - Hyperthermia
  - Hypothermia
  - Ineffective thermoregulation
  - Decreased cardiac output
  - Risk for injury
  - Ineffective breathing pattern

General Gerontologic Considerations

- Older adults tend to have lower “normal” body temps
- Older adults are encouraged to assess blood pressure at home to avoid “white coat hypertension”
- When collecting a baseline, check B/P in each arm while lying, sitting and standing
- Higher incidence of Hypertension
- More profound response to CV meds
- CV (cardiovascular disease) is more subtle

NORMALS

- Temperature: 96.6 – 99.3 F
- Pulse: 60 – 100 beats per minute
- Respiration: 14 – 20 breaths per minute
- Blood Pressure: < 120 / 80
- KNOW THESE plus CONVERSION FROM F to C AND C to F

Remember

- You will need your own stethoscope for skills lab practice and check offs
- Be calm and recheck vital signs as necessary. It takes time to learn this.
- Read skills and procedures at the end of chapter 12 to be able to learn proper techniques such as the release of the air at a rate of 2-3 mm Hg per second for BP and the proper placement of cuff.
- Teaching methods of VS constantly changing
2.5 point participation activity

• Put your name and ID# on the 2.5 point participation activity. Turn in before leaving class. Not accepted late and cannot make up if absent.