Vital Signs: Assessment and Interpretation

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Importance of Vital Signs

- Reported in some form since antiquity
- Provides a rapid overview of stability
- Helps to pinpoint cause of symptoms
- Can identify problems with the cardiac, pulmonary, renal and autonomic nervous system

Vital sign #1: PULSE

- Reflects heart rate (resting 60-90/min)
- Should be strong and regular
- Use 2 fingers over the carotid or radial artery—check for at least 30 seconds, then multiply by 2 to get rate/min
- Normal pulse reflects sinus node function, under parasympathetic control

Factors that influence pulse rate:

- Exercise (reflex tachycardia to increase blood flow to muscles and heart)
- Fever (elevates 10 b/m for every degree above 99F)
- Stimulants—direct effect on heart (cocaine, amphetamines)
- Vasodilation (e.g., reflex tachycardia with nitroglycerin due to diminished venous return)
- Hypovolemia (reflex tachycardia)
- Physical Condition (world-class athletes: HR 36/min)
- Hypometabolic states: hypothyroidism, hypothermia will slow rate
- Sinus node dysfunction (ischemia, old age, drugs)

What are the “Vital Signs”

Traditional: Pulse, Blood Pressure, Respiratory Rate, Temperature

Additional: Oxygen Saturation by Pulse Oximetry; Pain Index (0-10 scale)
Pulse can be palpated, but actual rhythm is determined by recording an electrocardiogram.

Rhythms that would cause Irregular and Regular Pulses:

Vital Sign #2 Temperature
- Reflects normal homeostasis (98.6°F)
- Will increase with hypermetabolic and inflammatory states: cocaine, infection, tissue damage, etc.
- Every degree of temp above normal will increase pulse by 10/min. Why?
- Hypothermia - core below 92 degrees F will slow heart rate
- Beware of mouth temperature/thermometer

Vital Sign #3: Respiration
- Normal rate is 14-18/min for adults
- Rate is driven by metabolic demands and pCO2
- Depth of respirations also important
- Usually increases along with heart rate
- Altered breathing seen in disease: Kussmaul’s, Cheyne-Stokes, Sleep Apnea

Vital sign 4: Blood Pressure
- BP=Cardiac Output X Systemic Vascular Resistance (i.e. tone in wall of vessels)
- Cardiac Output=HR X Stroke Volume (a function of heart’s contractility and amount of blood in Left Ventricle), so
- BP=HRXSVxSVR, so a change in any of these 3 factors will affect blood pressure

Blood pressure: normal 110/70
- Expressed as systolic (upper number) and diastolic (lower number) pressure in mm of mercury (mmHg)
- Determined by inflating BP cuff attached to manometer and measuring pressure in brachial artery
- Flow must be occluded and then gradually released to obtain the (systolic pressure) sound
- Loss of sound as cuff is further deflated is diastolic BP
- Referred to as Korotkoff sounds
- BP of 140/90 is consistent with hypertension if recorded at two or more settings
Pitfalls

- Cuff too big: artificially low BP
- Cuff too small: artificially high BP
- Old age and stiff blood vessels: requires higher pressure to occlude flow, giving artificially high BP
- Auscultatory Gap- transient loss of sound as cuff is deflated. Be sure to deflate cuff all the way to zero. Always palpate BP first.

Putting it all together

- The vital signs should be viewed as a group, because this method gives us the most information to form a differential diagnosis.

Let’s see if you can determine the causes of the following patients’ vital sign measurements:

Pulse Oximetry

- Measures oxygen saturation through the use of a transcutaneous device attached to the finger or earlobe
- Uses photodiode to measure absorption of light/infrared by blood
- Normal pulse oximetry measurements at room air: 98-100%

T 99  P 126  R 24  BP 100/60
Pulse Ox 90%  RA ; Pain 0/10

This 49 year old patient is complaining of shortness of breath after a surgical procedure. She is a non-smoker and has not been able to get out of bed for three days due to the surgery. She has never had any lung problems.

Pain Index (on a 0-10 scale)

- Makes sure that physicians address pain issues
- Allows us to quantify pain over time and in response to treatment
This 66 year old woman presents with one hour of severe, substernal chest pain.

This 49 year old medical school professor records these vital signs after running up six flights of stairs.

This 72 year old smoker presents coughing up green sputum for the past three days. He has inspiratory pain over the right middle lobe of the lung.
**This 72 year old woman has become progressively more limited in her activity, according to her family. Her voice has become deep and she complains of feeling cold all of the time. Her face has become puffy and she sleeps most of the day.**

**This 58 year old man is taking medication for high blood pressure. He complains of tiring easily when he exercises. You have taken his vital signs right after he has walked a brisk 100 yards.**

**This 16 year old girl just exited a Haunted House. She complains of feeling numb and tingly all over after being chased by a chain saw masker.**