ABGs (Arterial Blood Gases)

- pH: 7.35-7.45
- PCO2: 35-46 mmHg
- PO2: 80-100 mmHg
- SaO2Hb: 95-98%
- HCO3: 22-26 mEq/L

pH (7.35-7.45)

- Acid-base balance
- Can be disturbed due to respiratory or metabolic problems (these 2 systems can compensate for each other)
- Example: if patient is in metabolic acidosis, the respiratory system will kick in and RR will increase to get rid of the CO2
**PCO₂ 35-46 mmHg**
- Pressure of carbon dioxide in the blood (in mmHg)
- When PCO₂ increases, the patient becomes tired and sleepy and they tend to have increased secretions (so we need to put them in postural drainage positions)

**PO₂ 80-100 mmHg**
- If PO₂ is 35-40 mmHg (not consistent with life)
- If the reading is this low and the patient is awake and aware of their surroundings, then they most likely missed the artery and the reading is of venous blood

**SaO₂ Hb 95-98%**
- Saturation of oxygen: what percentage of hemoglobin is carrying oxygen?
**HCO₃**  
22-26 mEq/L  
- Bicarbonate: a buffering agent found in blood  
- HCO₃ increases with emphysema and respiratory failure  
- HCO₃ decreases with certain drugs, hyperventilation and severe CNS damage

**Lab Tests**

- K: 3.5 to 5.0 mEq/L  
- Glucose: 80-120 gm/DL

**K**  
3.5-5.0 mEq/L  
- Potassium is a mineral that regulates muscle movement  
- It can be high due to renal failure  
- If high, it can cause muscle weakness & fatigue  
- If low can cause weakness and cardiac arrhythmias, a slow/weak pulse and chest pain/palpitations  
- It can be low due to diet, diuretics, hyperglycemia, GI loss, skin loss, severe eating disorders
Glucose

- Glucose = blood sugar
- Normal fasting blood glucose = 70-100 milligrams/deciliter
- Can be increased:
  - Diabetes, stress, burns, shock, acute MI, drugs
- Can be decreased:
  - Pancreatic disorders, hepatic disease, endocrine disorders, malnutrition, alcoholism

Watchie, p263

Glucose continued

- When blood glucose levels are high before PT:
  - 250-300 mg/dL: should not perform vigorous or prolonged exercise
  - >300 mg/dL: should not perform any exercise
  - People with DM (especially type I) tend to have blunted HR responses to exercise

Watchie, p103

Glucose continued

- Clinicians should take precautions to avoid exercise-induced hypoglycemia:
  - Avoid scheduling appointments at the time of peak insulin effect or have the patient eat a carbohydrate snack 30 minutes before exercising
  - Start with moderate workloads and increase intensity gradually
  - Have carbohydrate snacks available
  - Know the signs of hypoglycemia

Watchie, p103
Signs of Hypoglycemia

- **Signs & Symptoms**
  - Sudden onset
  - Pale, moist skin
  - Excited, agitated
  - Normal breath odor
  - Normal to shallow breathing
  - No vomiting
  - Moist tongue
  - Hungry, not thirsty
  - Absent or slight glucose in urine

Lab Tests

- **White Blood Cell Count**: 4,500 – 11,000 mm$^3$
- **Hematocrit**: male: 43-49%
  female: 38-44%
- **Hemoglobin**: male: 14 – 18 gm/Dl
  female: 12 – 16 gm/Dl
- **Platelets**: 150,000 – 400,000 ul
- **International Normalized Ratio**: 0.9 – 1.1
  with anti-coagulants: 2-3

WBC 4,500 – 11,000 mm$^3$

- **White Blood Cell Count**: refers to the # of white blood cells per milliliter of blood.
- It is commonly used to identify the presence of an infection, allergens, bone marrow integrity or the degree of immunosuppression.
- An increase in WBC count can occur after hemorrhage, surgery, coronary occlusion or malignant growth.
- If WBC < 5,000 & the patient has a fever: HOLD exercise
Hematocrit
• Male 43-49%; Female 38-44%
• Hematocrit is the percentage of packed red blood cells in total blood volume.
• It is commonly used in the identification of abnormal states of hydration, polycythemia, and anemia.
• A low hematocrit may result in a feeling of weakness, chills or dyspnea.
• A high hematocrit may result in an increased risk of thrombus.
• If hematocrit < 25%, HOLD exercise

Hemoglobin
• Male 14-18 gm/Dl; Female 12-16 gm/Dl
• Hemoglobin is the iron containing pigment of the red blood cells. Hemoglobin’s function is to carry oxygen from the lungs to the tissues.
• This test is used to assess blood loss, anemia, and bone marrow suppression.
• Low hemoglobin may indicate anemia or recent hemorrhage.
• Elevated hemoglobin suggests polycythemia or dehydration.
• If hemoglobin < 8 gm/Dl: HOLD exercise

Platelets
• 150,000-400,000 ul
• Platelet Count refers to the # of platelets per microliter of blood.
• Platelets play an important role in blood coagulation, homeostasis, and blood thrombus formation.
• Low platelet counts increase the risk of bruising and bleeding.
• High platelet counts increase the risk of thrombus.
• If platelet count < 20,000: HOLD exercise
**INR**

- International Normalized Ratio
- INR: 0.9 - 1.1
  - with anti-coagulants: 2-3

INR: International normalized ratio, a system established by the World Health Organization (WHO) and the International Committee on Thrombosis and Hemostasis for reporting the results of blood clotting tests. All results are standardized using the international sensitivity index for the particular thromboplastin reagent and instrument combination utilized to perform the test.

For example, a person taking the anticoagulant ("blood thinner") warfarin (brand name: Coumadin) might optimally maintain a prothrombin time (a "pro time" or PT) of 2 to 3 INR. No matter what laboratory checks the prothrombin time, the result should be the same even if different thromboplastins and instruments are used. This international standardization permits the patient on warfarin to travel and still obtain comparable test results.

**Lab Tests**

**How long it takes blood to clot**

- PT (Prothrombin time) & PTT (Partial thromboplastin time)
  - Most commonly used to monitor oral anticoagulant therapy or to screen for selected bleeding disorders.
  - PTT is more sensitive than PT in detecting minor deficiencies.

**Lab Tests**

- CBC:
  - Complete blood count = total WBC, RBC, platelets
- BUN: 8-25 mg/dL
  - Blood urea nitrogen – rises with renal failure, elevated with CHF, DM
**ICU**

- Physical therapy goals in the ICU
  - Preservation of life
  - Work toward reduction of complications
  - Restoration of maximal function

**ICU Equipment**

- A-line (Arterial Line)
  - Direct arterial puncture usually in radial artery
  - Provides constant monitoring of systolic & diastolic BP and it reads ABGs
  - PTA must guard against dislodging it because profuse bleeding occurs
  - Wrist IV board to keep wrist in neutral
  - If A-line is in UE, WB & ambulation are possible as long as line goes along too
  - If A-line is in femoral or pedal artery, WB & ambulation not permitted, unless ordered by MD
  - If in femoral artery, cannot flex hip past 30 degrees

**IVs**

- Intravenous Line
  - It’s function is to provide an immediate route for fluids, electrolytes, nutrition or medications to the patient. It is also a route for blood transfusions; can obtain blood work from it
  - Usually in the external jugular in the arm or hand
  - Be careful regarding dislodging it
CVP Line
- Central Venous Pressure Line
  - A catheter inserted in the subclavian or internal jugular & it lies right in the superior vena cava just above the right atrium
  - It measures the right arterial pressure and gives us information regarding cardiac function and the intravascular fluid status of the patient
  - Almost every patient after cardiac surgery
  - No mobility restrictions, no ROM contraindications
  - When rolling, the tip of the catheter can become advanced and cause PVCs

Pulmonary Artery Catheter
- AKA Swan Ganz Catheter
  - The most invasive line used in the CCU
  - It is a soft, flexible catheter that is inserted through a vein into the pulmonary artery. It provides continuous measurements of pulmonary artery pressure.
  - It monitors the left side heart pressures and CO
  - It helps the MD manage fluid balance and CO
  - Patients can exercise with this is place, but avoid activities that increase pressure on the insertion site.

Swan Ganz Catheter continued
- No restrictions with routine ROM & positioning
- Catheter tends to be short, so move the patient cautiously
- If dislodged, apply pressure and call the nurse immediately
- Arrhythmias can occur upon insertion and following removal of this catheter
- Mobility depends on the unit & the MD orders
Chest Tubes

- Located in the pleural or mediastinum cavity
- If it’s purpose is to remove air, the tube is located at the 2, 3, or 4th intercostal space
- If it’s purpose is to drain fluid, the tube is located at the 6, 7, or 8th intercostal space
- There is a drainage collection chamber that may be connected to the wall (need MD clearance to ambulate these patients)
- PT/PTAs DO NOT actually detach the unit from the wall

Chest Tubes continued

- Make sure the drainage collection chamber is below waist level when carrying it (ambulating a patient) and DO NOT tip it
- There is a risk of pneumothorax developing when the chest tubes are removed. The patient will then have a chest X-Ray. Hold treatment until the chest X-Ray results are back.
Mechanical Ventilation

- Respirators / ventilators
- Modes and parameters are set by RTs
- Be aware of the parameters
  1. **Continuous Mandatory Ventilation (CMV)**
     - Patient gets all breaths from ventilator at a preset frequency, volume, and flow rate
  2. **Assisted Mandatory Ventilation**
     - Preset volume, frequency, & flow rate. If a patient tries to take a breath on their own, machine assists them
  3. **Intermittent Mandatory Ventilation (IMV)**
     - Preset volume, frequency, & flow rate. Patient can take breaths spontaneously on their own in between cycles
     - Used to wean patients off the ventilator
  4. **Synchronized IMV**
     - Breaths of the ventilator are synchronized with the patient’s spontaneous breaths
  5. **Continuous Positive Airway Pressure (CPAP)**
     - Common mode for home care, sleep apnea
     - Pt breaths their own breaths, the machine leaves constant pressure in the system so the patient never breathes out entirely
  6. **Positive End Expiratory Pressure (PEEP)**
     - At the end of expiration, pressure left in airway so alveoli don’t collapse
     - Adult Respiratory Distress Syndrome (RDS)

**Nasal Cannula**

- A nasal cannula consists of tubing extending approximately one centimeter into each of the patient’s nostrils.
- The tubing is connected to a common tube that is attached to an oxygen source.
- This method of oxygen therapy is capable of delivering up to 6 liters of oxygen per minute.
Pulse Oximetry
- Non-invasive, applied to finger or ear
- Measures % of hemoglobin that is saturated with oxygen
- Has light emitting diode, a photodiode signal detector and a microprocessor
- It is a warning system
- Be aware that the results can be misinterpreted (did the patient have a cigarette within the hour, nail polish, anemia, dye injection)
- Hold treatment if less than 90%

Pulse Oximeter

ICP monitoring
- Intracranial Pressure Monitoring
  - Most commonly placed in intraventricular space
  - Common in head trauma
  - Drill a burr hole into the cranium
  - Insert the catheter into the cerebrum
  - Normal ICP = 0-15 mmHg
- PRECAUTIONS:
  - HOB up at least 30 degrees
  - Avoid severe neck flexion
  - Avoid valsalva
ICP Monitors

Urinary Catheters

- **External Catheter**
  - Applied over the shaft of the penis & held in place by a padded strap or adhesive tape
- **Foley Catheter**
  - An indwelling urinary tract catheter that has a balloon attachment at one end
- **Suprapubic Catheter**
  - An indwelling urinary catheter that is surgically inserted directly into the patient’s bladder (performed under general anesthesia)

Foley Catheter Bag
Nasogastric Tube

- AKA: NG Tube
- A plastic tube inserted through a nostril that extends into the stomach.
- The device is commonly used for liquid feeding, medication administration or to remove gas from the stomach.

ICU Video

- [http://www.youtube.com/watch?v=OalkITgyh6Ze](http://www.youtube.com/watch?v=OalkITgyh6Ze)

Questions??