



## CSRT Rapid Response Return to Practice Toolkit – Patient Monitoring

### Resources (Basic Review):

- Arterial blood gas interpretation review (Includes anion gap.): [Click here](#)
- Capnography educational website: [Click here](#)
- Chest x-ray interpretation: [Click here](#)
- Chest-ray interpretation mnemonic ABCDEFGHI: [Click here](#)
- Pulse oximetry review article: [Click here](#)
- Pulse oximeter review video (includes function, limitations and troubleshooting): [Click here](#)

### Industry-Developed Resources:

- Arterial blood gas procurement video: [Click here](#)
- Basic Hemodynamics (Medtronic): [Click here](#)
- Continuous Pulse Oximetry (Medtronic): [Click here](#)
- CapnoAcademy (Capnography) (Medtronic): [Click here](#)
- Masimo Showpad (with instructional videos for Mighty Sat Rx, Root vital signs monitor, Rad 97 pulse co-oximeter, Rad 97 with normaline capnography, Radius PPG monitor [tetherless pulse oximeter]) [Click here](#)
- Masimo adhesive taps and wraps: [Click here](#)
- Masimo correct and incorrect sensor application: [Click here](#)
- Various courses relating to Capnography (Medtronic): [Click here](#)

The CSRT Rapid Response Refresher Resource is intended to provide respiratory therapists with review materials. For information specific to the management of Coronavirus disease, please refer to the CSRT COVID-19 resource page: <https://www.csrt.com/csrt-novel-coronavirus-resources/>.



### Chest X-Ray Interpretation

**A:** Assess quality and airways:

Position: PA, AP, lateral?

Exposure: Is there good lung detail? Can you see the spinal column?

Rotation: Is the space between each clavicle equidistant from midline?

Inflation: Can you see 10-11 ribs?

**B:** Bones and soft tissues

Bones: symmetry, fractures, lesions

Soft tissues: subcutaneous air, foreign bodies, swelling

**C:** Cardiac: Is the heart approximately 50% of the chest diameter (PA film)?

**D:** Diaphragm: Is right side slightly higher than the left? Is there free air beneath the diaphragm?

**E:** Effusions and extrathoracic soft tissues: Are costophrenic angles sharp?

**F:** Fields, fissures and foreign bodies: Check for infiltrates, masses, consolidation, air bronchograms, pneumothoraces and vascular markings (vessels should taper and be invisible at periphery). Check fissures for thickening or altered position. Check the position of foreign bodies (ETT, lines, pacer)

**G:** Great vessels and gastric bubble: Check size and shape of aorta and outline of pulmonary vessels. Check gastric bubble.

**H:** Hila and mediastinum: Look for lymphadenopathy, calcifications and masses. Look for widening of the mediastinum and tracheal deviation.

**I:** **Impression:** Synthesize findings to form clinical impression.

(<https://radiopaedia.org/articles/chest-radiograph-assessment-using-abcdefghi>)



#### **Selected etiologies of respiratory acidosis**

- Airway obstruction (upper or lower)
- COPD
- Asthma
- other obstructive lung disease
- CNS depression
- Sleep disordered breathing (OSA or OHS)
- Neuromuscular impairment
- Ventilatory restriction
- Increased CO<sub>2</sub> production (shivering, rigors, seizures, malignant hyperthermia, hypermetabolism, increased intake of carbohydrates)
- Incorrect mechanical ventilation settings

#### **Selected causes of metabolic alkalosis**

- Hypovolemia with Cl<sup>-</sup> depletion
- GI loss of H<sup>+</sup>
- Vomiting, gastric suction, villous adenoma, diarrhea with chloride-rich fluid
- Renal loss H<sup>+</sup>
- Loop and thiazide diuretics, post-hypercapnia (especially after institution of mechanical ventilation)
- Hypervolemia, Cl<sup>-</sup> expansion

Table from Kaufman, D. Interpretation of Arterial Blood Gases. American Thoracic Society.

<https://www.thoracic.org/professionals/clinical-resources/critical-care/clinical-education/abgs.php>

#### **Selected etiologies of respiratory alkalosis**

- CNS stimulation: fever, pain, fear, anxiety, CVA, cerebral edema, brain trauma, brain tumor, CNS infection
- Hypoxemia or hypoxia: lung disease, profound anemia, low FiO<sub>2</sub>
- Stimulation of chest receptors: pulmonary edema, pleural effusion, pneumonia, pneumothorax, pulmonary embolus
- Drugs, hormones: salicylates, catecholamines, medroxyprogesterone, progestins
- Pregnancy, liver disease, sepsis, hyperthyroidism
- Incorrect mechanical ventilation settings

#### **Selected etiologies of metabolic acidosis**

##### Elevated anion gap:

- Lactic acidosis
- Methanol intoxication
- Uremia
- Ketoacidosis
- Paraldehyde toxicity
- Isoniazid
- Tissue ischemia
- Altered cellular metabolism
- Ethanol or ethylene glycol intoxication
- Salicylate intoxication

##### Normal anion gap:

- GI loss of HCO<sub>3</sub><sup>-</sup>
- Renal loss of HCO<sub>3</sub><sup>-</sup>
- Renal tubular disease



## NORMAL AND ABNORMAL etCO<sub>2</sub>/CAPNOGRAPH WAVEFORMS

### Normal Capnogram

The normal capnogram is a waveform which represents the varying CO<sub>2</sub> level throughout the breath cycle.

#### Waveform Characteristics:

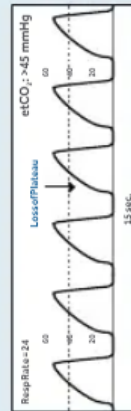
- A-B: Baseline
- C: End-Tidal Concentration
- D: Expiratory Upstroke
- E: Inspiration
- D-E: Expiratory/Plateau



### Bronchospasm/Asthma

#### Other Possible Causes:

- Bronchospasm/COPD
- Obstruction in the expiratory limb of the breathing circuit
- Presence of a foreign body in the upper airway
- Partially kinked or occluded artificial airway



### Rebreathing CO<sub>2</sub>

#### Other Possible Causes:

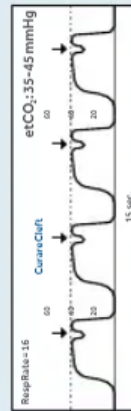
- Faulty expiratory valve
- Inadequate inspiratory flow
- Partial rebreathing
- Insufficient expiratory time



### Curare Cleft

#### Other Possible Causes:

- Patient is mechanically ventilated
- Depth of cleft is proportional to degree of muscle relaxants



### \*Increasing etCO<sub>2</sub> (Hypoventilation)

#### Other Possible Causes:

- Decrease in respiratory rate
- Decrease initial volume
- Increase in metabolic rate
- Rapid rise in body temperature (malignant hyperthermia)



### \*Decreasing etCO<sub>2</sub> (Hyperventilation)

#### Other Possible Causes:

- Increase in respiratory rate
- Increase in tidal volume
- Metabolic acidosis
- Fall in body temperature



### Cardiac Arrest

#### Other Possible Causes:

- Decreased or absent cardiac output
- Decreased or absent pulmonary blood flow
- Sudden decrease in CO<sub>2</sub> values



### Return of Spontaneous Circulation

#### Other Possible Causes:

- Increase in cardiac output
- Increase in pulmonary blood flow
- Gradual increase in CO<sub>2</sub> production



\* Assumes adequate circulation and alveolar exchange

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