5. Nitroglycerin reduces left ventricular filling pressure primarily via venous dilation. At higher doses the drug variably lowers systemic afterload and increases stroke volume and cardiac output
6. Pulmonary edema is more commonly a problem of volume distribution than total body fluid overload, so administration of diuretics such as furosemide provide no immediate benefit for most patients and can cause significant harm. Inducement of inappropriate diuresis can lead to increased morbidity and mortality in patients with other disease processes such as pneumonia and sepsis
7. Nitrates provide both subjective and objective improvement, and might decrease intubation rates, incidence of MIs, and mortality. High-dose nitrates can reduce both preload and afterload and potentially increase cardiac output and blood pressure
8. If available and trained, ultrasound is useful to distinguish pulmonary edema from other causes of respiratory distress (including pneumothorax)
9. Pulmonary edema due to irritant gas inhalation (i.e., chlorine) generally is best managed by supportive care and escalation of airway interventions as above once the patient is appropriately decontaminated. Early poison center consultation should be strongly considered for guidance
10. Pulmonary edema due to high altitude should be managed as described in Altitude Illness Guideline

Pertinent Assessment Findings

1. Severe respiratory distress may manifest with hypoxia, altered mentation, diaphoresis, or inability to speak more than 2–3 words
2. In the setting of severe bronchoconstriction, wheezing may not be heard. Patients with known asthma with severe dyspnea should be empirically treated, even if wheezing is absent
3. A "shark fin" on waveform capnography suggests significant bronchospasm and obstructive physiology
4. Etiology of respiratory distress:
    a. Bronchospastic etiology (e.g., asthma, COPD) is suggested by:
        i. Wheezing on auscultation
        ii. "Shark fin" waveform capnograph or prolonged expiratory phase
        iii. History of asthma/COPD
    b. Fluid overload etiology (e.g., CHF, pulmonary edema) is suggested by:
        i. Jugular venous distention
        ii. Rales on auscultation
        iii. Peripheral edema
        iv. History of CHF, diuretic therapy, dialysis noncompliance, hypertension

Quality Improvement

Associated NEMSIS Protocol(s) (eProtocol.01) *(for additional information, go to www.nemsis.org)*

- 9914137 – Pulmonary Edema/CHF
- 9914139 – Respiratory Distress/Asthma/COPD/Croup/Reactive Airway

Key Documentation Elements

Document key aspects of the exam at baseline and after each intervention:

- Respiratory rate