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Emergency clinicians are tasked with managing a variety of patients with acute deformities. One of the most acute situations management of the patient who presents with an airway emergency. Patients present with various pathologies may result in anatomically challenging intubation scenarios. Deferral of intubation is often not an option in the emergency department. In some cases, challenging anatomic issues can be predicted before beginning laryngoscopy, but in many situations, prediction models fall short. It is critically important for emergency clinicians to anticipate anatomic issues in all airways and to have premeditated strategies for managing them.

Acute Respiratory Distress Syndrome  459
Alin Gragossian and Matthew T. Siuba

Acute respiratory distress syndrome (ARDS) occurs in up to 10% of patients with respiratory failure admitted through the emergency department. Use of noninvasive respiratory support has proliferated in recent years; clinicians must understand the relative merits and risks of these technologies and know how to recognize signs of failure. The cornerstone of ARDS care of the mechanically ventilated patient is low-tidal volume ventilation based on ideal body weight. Adjunctive therapies, such as prone positioning and neuromuscular blockade, may have a role in the emergency department management of ARDS depending on patient and department characteristics.

Basic Modes of Mechanical Ventilation  473
Jared Ward and Christopher Noel

Acute respiratory failure requiring invasive mechanical ventilation is a common presentation in the emergency department. Providers can further improve care for these patients by understanding common modes of mechanical ventilation, recognizing changes in respiratory mechanics, and tailoring ventilator settings and therapies accordingly.

Rory Spiegel and Max Hockstein

Airway pressure release ventilation (APRV) is a mode of ventilation that uses high airway pressures to recruit and maintain patients' lung volumes. The goal of this mode of ventilation is 2-fold: first, to maintain patients as close to their functional residual capacity as possible and second, to promote safe spontaneous breathing. APRV should essentially be viewed as continuous positive airway pressure (CPAP), with intermittent releases of that pressure to metabolically support patients who are incapable of managing their ventilatory load. As patients recruit and lungs approach the patients' natural lung volumes, their ability to breathe spontaneously and manage their own ventilatory needs improves. Eventually, patients are able to fully support their ventilatory needs and no longer require any release breaths to maintain normal CO₂ levels. Now, patients can be “stretched” to CPAP.

Infectious Pulmonary Diseases

Rachel Rafeq and Lauren A. Igneri

Pneumonia is a lower respiratory tract infection caused by the inability to clear pathogens from the lower airway and alveoli. Cytokines and local inflammatory markers are released, causing further damage to the lungs through the accumulation of white blood cells and fluid congestion, leading to pus in the parenchyma. The Infectious Diseases Society of America defines pneumonia as the presence of new lung infiltrate with other clinical evidence supporting infection, including new fever, purulent sputum, leukocytosis, and decline in oxygenation. Importantly, lower respiratory infections remain the most deadly communicable disease. Pneumonia is subdivided into three categories: (1) community acquired, (2) hospital acquired, and (3) ventilator associated. Therapy for each differs based on the severity of the disease and the presence of risk factors for methicillin-resistant Staphylococcus aureus or Pseudomonas aeruginosa.

Right Ventricular Failure and Pulmonary Hypertension

Sara E. Crager and Caroline Humphreys

Right ventricular dysfunction is an important component of the pathophysiology of several disorders commonly encountered in the emergency department (ED). Interventions often performed routinely early in the ED course such as fluid administration and endotracheal intubation have the potential to cause precipitous clinical deterioration in patients with right ventricular failure and pulmonary hypertension. It is important for emergency physicians to understand the pathophysiology of acute decompensated right ventricular failure in order to avoid common pitfalls in diagnosis and management that can result in significant morbidity and mortality.

Evaluation and Management of Asthma and Chronic Obstructive Pulmonary Disease Exacerbation in the Emergency Department

Brit Long and Salim R. Rezaie

Obstructive lung disease includes asthma and chronic obstructive pulmonary disease (COPD). Exacerbation of asthma or COPD can result in
significant morbidity and mortality, and emergency department (ED) care is often required. ED evaluation should assess risk factors for severe exacerbation and the patient’s hemodynamic and respiratory status. Assessments including chest radiograph, point-of-care ultrasound, capnography, and electrocardiogram can assist. First-line treatments for acute exacerbation include bronchodilators and corticosteroids. Noninvasive ventilation, magnesium, ketamine, and epinephrine should be considered in those with severe exacerbation. Mechanical ventilation is challenging and should use an obstructive lung strategy with permissive hypercapnia.

**Diagnosis and Management of Pulmonary Embolism**

Terren Trott and Jason Bowman

Pulmonary embolism is a challenging pathology commonly faced by emergency physicians, and diagnosis and management remain a crucial skill set. Inherent to the challenge is the breadth of presentation, ranging from asymptomatic pulmonary emboli to sudden cardiac death. Diagnosis and exclusion have evolved over time and now use a combination of clinical decision calculators and updates to the classic d-dimer cutoffs. Management of pulmonary emboli revolves around appropriate anticoagulation, which for most of the patients will comprise newer oral agents. However, there remains a substantial degree of practice variation and ambiguity when it comes to higher risk patients with submassive or massive pulmonary emboli.

**Special Procedures for Pulmonary Disease in the Emergency Department**

Brian C. Park and Haney Mallemat

In the emergency department, there are infrequent but essential procedures related to pulmonary diseases that emergency physicians must be able to perform. These include thoracentesis, chest tube thoracostomy, tracheostomy manipulation, and fiberoptic intubation.

**Noninvasive Mechanical Ventilation**

Harman S. Gill and Evie G. Marcolini

This article explains the physiologic basis and fundamentals behind the technology of continuous positive airway pressure, bilevel positive airway pressure, and high flow nasal cannula. Additionally, it explores some of the core literature behind their clinical applications. It will also compare HFNC with other noninvasive modalities for respiratory failure alongside clinical titration and weaning algorithms in the emergency department setting.

**The Physiologically Difficult Intubation**

Kenneth Butler and Michael Winters

Emergency physicians intubate critically ill patients almost daily. Intubation of the critically ill emergency department (ED) patient is a high-risk, high-stress situation, as many have physiologic derangements such as hypotension, hypoxemia, acidosis, and right ventricular dysfunction that markedly increase the risk of peri-intubation cardiovascular collapse and
cardiac arrest. This chapter discusses critical pearls and pitfalls to intubate
the critically ill ED patient with physiologic derangements. These pearls
and pitfalls include appropriate preoxygenation; circulatory resuscitation;
proper patient position and room setup; selection of medications for rapid
sequence intubation; and intubation of patients with severe acidosis, trau-
matic brain injury, and pulmonary hypertension.