

## 1.03 ACUTE RESPIRATORY FAILURE

### Introduction

Respiratory failure is defined by inadequate gas exchange by the respiratory system that results in ineffective alveolar ventilation and/or oxygenation. Acute respiratory failure is more common in children than adults and is the primary cause of cardiopulmonary arrest in children. The differential diagnosis for acute respiratory failure in children is extensive, as failure may stem from any portion of the respiratory system or be a consequence of systemic disease. Pediatric hospitalists frequently encounter children with conditions affecting the respiratory system and should be able to anticipate, identify, and treat acute respiratory distress and acute respiratory failure in children, including those with chronic respiratory conditions and other comorbidities.

### Knowledge

Pediatric hospitalists should be able to:

- Describe the structure and function respiratory system components, including upper and lower airways, muscles of respiration, and central and peripheral regulation systems.
- Explain developmental differences that contribute to acute respiratory failure in infants and young children, including upper airway size, lower airway growth and development, diaphragmatic muscle reserve, chest wall compliance, and respiratory regulatory center maturity.
- Discuss the basic principles of respiratory physiology, including the alveolar gas equation, minute ventilation, and alveolar-arterial gradient.
- Summarize the five causes of hypoxemia: ventilation-perfusion mismatch, hypoventilation, right to left shunt, diffusion impairment, and low inspired oxygen.
- Construct an age-based differential diagnosis for acute respiratory distress in children.
- List causes of poor respiratory muscle function, attending to age, neuromuscular disorders, central nervous system dysfunction, nerve injury, and others.
- Discuss comorbidities that place children at higher risk for acute respiratory failure.
- Summarize evaluation, monitoring, and treatment options for patients with worsening respiratory status, including mental status assessment, blood gas analysis, medications, and respiratory support.
- Describe the signs and symptoms of impending acute respiratory failure, including criteria for transfer to a higher level of care.
- Discuss the advantages and disadvantages of different supplemental oxygen delivery devices for children with and without medical complexity, such as low flow and heated high-flow nasal cannula, simple mask, partial rebreather or non-rebreather, and tracheostomy collar or mask.
- Summarize the modalities commonly available to support the airway and adequate gas exchange in children with worsening respiratory distress, including nasopharyngeal or oropharyngeal airways, bag-valve-mask ventilation, bi-level

positive airway pressure, continuous positive airway pressure, endotracheal tube, and laryngeal-mask-airway intubation.

- Describe criteria for, risks of, and complications due to endotracheal or laryngeal-mask-airway intubation, including strategies to reduce these risks.
- Compare and contrast optimal treatment strategies for acute respiratory failure in children with common acute respiratory conditions, including asthma, bronchiolitis, croup, and pneumonia.

### Skills

Pediatric hospitalists should be able to:

- Perform and teach other health care providers to perform a thorough respiratory assessment of a child with acute respiratory distress.
- Identify early warning signs of acute respiratory distress and institute corrective actions and therapies to avert further deterioration.
- Identify patients with comorbidities and other risk factors for progression to acute respiratory failure.
- Order appropriate monitoring and relevant testing (such as radiographs and blood gases) and correctly interpret their results.
- Diagnose and initiate medical management for systemic causes of acute respiratory failure.
- Identify signs and symptoms of impending acute respiratory failure and activate local emergency response teams and/or transfer patients to an appropriate site with critical care services in a safe and efficient manner.
- Initiate oxygen supplementation via oxygen delivery devices and escalate as required to manage hypoxia and/or acute respiratory distress.
- Stabilize the airway, using non-invasive airway management techniques independently and invasive airway management in collaboration with other services.
- Demonstrate proficiency in basic management of patients with chronic respiratory support needs.
- Identify patients requiring subspecialty care and obtain timely consults.

### Attitudes

Pediatric hospitalists should be able to:

- Acknowledge the importance of collaboration with patients, the family/caregivers, hospital staff, and subspecialists to ensure family-centered, coordinated hospital care for children with conditions at risk for acute respiratory failure.
- Realize the value of providing consultation for healthcare providers in community settings to ensure transport of patients to higher acuity settings as needed.

### Systems Organization and Improvement

In order to improve efficiency and quality within their organizations, pediatric hospitalists should:

- Lead, coordinate, or participate in educational programs for the family/caregivers, hospital staff, and other healthcare providers regarding recognition of signs and symptoms of

acute respiratory distress in children, particularly those at higher risk for acute respiratory failure.

- Work with hospital administration, hospital staff, subspecialists, and others to develop, implement, and assess outcomes of intervention strategies such as rapid response teams and early warning scores for hospitalized patients with deterioration in respiratory status in order to prevent adverse outcomes.
- Work with hospital administration, hospital staff, pharmacy, and others to ensure availability of medications and ap-

propriately sized equipment for use in the management of acute respiratory failure in children.

## References

1. Samson RA, Schexnayder SM, Hazinski MF, et al. Part 3 Systematic approach to the seriously ill or injured child, Part 6 Recognition of Respiratory Distress and Failure, and Part 7 Management of Respiratory Distress and Failure. In: *Pediatric Advanced Life Support: Provider Manual*. Dallas, TX: American Heart Association; 2016;29-68; 113-170.
2. Hammer J. Acute respiratory failure in children. *Paediatr Respir Rev*. 2013; 14:64-69. <https://doi.org/10.1016/j.prrv.2013.02.001>.