Fundamental Critical Care Support Skill Station
Noninvasive Positive Pressure Ventilation
Participant Guide

Estimated completion time: 45-60 minutes

This skill station represents the practical application of the concepts presented in the textbook chapters, Diagnosis and Management of Acute Respiratory Failure and Mechanical Ventilation. Case scenarios are presented to create a framework for emphasizing the essential concepts in the use of NPPV in the management of the patient with respiratory failure. The pitfalls of NPPV, particularly in regard to inappropriate patient selection, must be understood.

Station Goals
The goals of this station are to:

- Identify appropriate candidates for noninvasive ventilation.
- Understand how to initiate and adjust noninvasive mechanical ventilation.
- Interpret arterial blood gases correctly.

Participant Objectives
After completing this skill station, the student should be able to:

- List diagnoses for which NPPV may be an appropriate therapy.
- List characteristics of a patient who is a good candidate for NPPV.
- Discuss the contraindications to NPPV.
- Describe techniques to facilitate patient acceptance of NPPV.
- Summarize the monitoring requirements for a patient treated with NPPV.

Case Scenario 1	Critical Elements
A 68-year-old woman with severe pulmonary emphysema and chronic bronchitis due to nicotine dependence from cigarettes presents with a chief complaint of progressive dyspnea at rest and with exertion over the past week. She continues to smoke one pack per day, but is trying to quit. She has a cough productive of yellow sputum, but denies hemoptysis or fever. The use of her home nebulized bronchodilators has increased to every 4 hours, but she states that the improvement in breathing is transient. Vital signs include the following: temperature 38.1°C (100.5°F), pulse 118 beats/min, sinus tachycardia, respiratory rate 32 breaths/min, blood pressure 148/94 mm Hg, and oxygen saturation 85% on room air. Pertinent examination findings include the following: sitting in a tripod position, accessory muscle use, nasal flaring, prolonged expiratory phase with wheezing, and only able to answer questions in 2-3 words before needing to take a breath. Chest radiograph demonstrates hyperinflation without an obvious infiltrate. Room air arterial blood gas results: pH 7.29, P_{CO_2} 64 mm Hg, P_{O_2} 57 mm Hg, arterial O_2 saturation 86%, HCO_3 30.8 mmol/L. Review of her medical record reveals eight admissions in the last 10 months for an exacerbation of chronic obstructive pulmonary disease (COPD).	**Notes**

Detection

Q. What factors are important in your assessment of the patient's respiratory status? [*Chapter 1, Assessment*]	

Q. What information is missing that is important to his assessment?	
Q. How would you interpret the arterial blood gas information? [*Chapter 6, Monitoring*]	
Q. Is this patient an appropriate candidate for NPPV? Ask for patient characteristics that would make her an appropriate candidate for NPPV. [*Chapter 5, Mechanical Ventilation*]	

Q. Why not just proceed to intubation immediately in this patient?	

Intervention

Q. How would you initiate NPPV in this patient, including the type of interface and the type of mechanical ventilator with initial settings?	Type of interface
	Type of mechanical ventilator support
	Initial settings

How would you titrate NPPV support in this patient to change tidal volume, minute ventilation, and oxygenation?	

Reassessment	
Q. NPPV is initiated via a full face mask with IPAP set at 10 cm H_2O, EPAP 5 cm H_2O, and F_{IO_2} 40%. What parameters should be monitored to assess the patient's response to NPPV?	
Q. What adjustments would you make to increase the tidal volume or minute ventilation?	

Q. What adjustments would you make to increase the oxygen saturation?

Effective Communication and Teamwork

Q. Successful initiation of NPPV hinges on patient acceptance of the interface and mechanical ventilator. What can be done at the initiation of NPPV support to improve patient acceptance and tolerance?

Case Scenario 1: Outcome
NPPV support is initiated with a full face mask, IPAP 10 cm H_2O, EPAP 5 cm H_2O, FIO_2 100%. The patient has a decreased sense of dyspnea. Respiratory rate decreases. Clinical examination reveals no nasal flaring or accessory muscle use. The FIO_2 is weaned to 40% to maintain an O_2 saturation on pulse oximetry >90%. One hour later, arterial blood gas results are: pH 7.34, PCO_2 58 mm Hg, PO_2 73 mm Hg, and arterial O_2 saturation 96%. The decision is made to admit the patient to the general medicine service.

Reassessment

Q. What care location would you advise for this patient's admission?

Q. How would you determine if NPPV support has failed and endotracheal intubation with mechanical ventilator support is needed?

Case Scenario 2	Critical Elements
A 28-year-old man is dropped off by his friends outside the emergency department. His Glasgow Coma Scale score is 8. A painful stimulus elicits a response of opening of eyes, incomprehensible sounds, and withdrawal at the site of stimulus. There is no gag or cough reflex elicited. Chest radiograph shows no acute infiltrates, but decreased inspiratory effort. Laboratory analysis is pending. Computed tomography scan of the brain reveals no hemorrhage, no shift, no ischemia, and no edema. A non-rebreather mask is applied with flush supplemental oxygen. Administration of naloxone does not change his examination findings. Vital signs are as follows: temperature 36.4°C (97.5°F), respiratory rate 10 breaths/min, heart rate 124 beats/min, blood pressure 94/56 mm Hg, and an O_2 saturation on pulse oximetry 94%. Arterial blood gas findings are as follows: pH 7.16, P_{CO_2} 70 mm Hg, P_{O_2} 69 mm Hg, arterial O_2 saturation 94.1%, and HCO_3 24 mmol/L.	**Notes**

Detection	
Q. What factors are important in your assessment of the patient's respiratory status? What information is missing that is important to your assessment?	
Q. How would you interpret the arterial blood gas values?	

Q. Is this patient an appropriate candidate for NPPV support?	
Intervention	
Q. What interventions should be initiated?	