PROCEDURE:

Recognize the indications for non-invasive mechanical ventilation. 
Understand the initial treatment and continued management of non-invasive mechanical ventilation.

DEFINITION/DESCRIPTION:

Non-invasive mechanical ventilation refers to the delivery of positive pressure to the lungs by utilizing techniques such as an unvented mask that do not require an endotracheal airway. NIV is a short term option that is used to treat an acute condition of anticipated short duration. NIV may be utilized intermittently or continuously however, if used continuously for >24 hours intubation should be considered. NIV may decrease the work of breathing and thereby improve alveolar ventilation while simultaneously resting the respiratory muscles. The improvement in gas exchange with NIV occurs because of an increase in alveolar ventilation. Externally applied expiratory pressure decreases the work of breathing partially overcoming the auto PEEP which is frequently present in patients requiring NIV. The patient generates less inspiratory force to initiate a breathing cycle. Acutely, continuous support is given to patients. As the underlying condition improves, ventilator free periods are increased as tolerated and support is discontinued when the patient is deemed stable. The recent increase in the use of NIV in the acute care setting has been fueled by the desire to decrease complications of invasive ventilation. NIV has the potential of reducing hospital morbidity, facilitating the weaning process, shortening length of stay thereby costs, and improving patient comfort. However, patients must be selected carefully because risks of complications could be increased if NIV is used inappropriately.

Settings:
1. ICU
2. Emergency department/ Critical Care room
3. Recovery Room

Indications: (Acute condition of anticipated short duration)
1. Impending respiratory failure/respiratory distress
2. Acute or acute on chronic CO2 retention
3. Severe hypoxemia
4. As a bridge to recovery from muscle weakness immediately after surgery to avoid re-intubation

Contraindications: (Relative)
1. Cardiac/respiratory arrest
2. Hemodynamic instability ( not responsive to fluids/pressors)
3. Uncontrolled arrhythmias
4. Severe upper GI bleeding
5. Multi-organ system failure
6. High risk for aspiration
7. Excessive amount of respiratory secretions
8. Inability to cooperate with procedure
9. Inability to fit mask properly
10. Recent facial surgery/facial trauma/or deformity
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11. Recent upper GI and/or airway surgery
12. Agonal breathing/ apnea
13. Obstructive bowel
14. Coma
15. Intracranial pressure >20 mmHg
16. Acute sinusitis
17. Epitaxis
18. Recent Esophageal surgery
19. Active hemoptysis
20. Nausea/vomiting
21. Known or suspected tympanic membrane rupture or other middle ear pathology
22. Untreated pneumothorax
23. Full Stomach

Hazards/Complications:
1. Cardiovascular compromise/decreased venous return/ myocardial ischemia
2. Air swallowing/increased likelihood of vomiting and aspiration
3. Claustrophobia
4. Skin breakdown and discomfort from mask
5. Pulmonary barotrauma
6. Increased intracranial pressure

Cautions:
1. Recommend waiting 1 hour post oral food intake before initiation/re-initiation of NIV
2. Consider placement of NG tube to decrease risk of aspiration
3. Provide the optimal level of humidity appropriate for clinical situation

Limitations of Method:
1. Short term solution/ “bridge”/ not to be utilized long term/ continuous use limited to <48 hours
2. Does not provide airway protection against aspiration
3. Equipment-intensive procedure
4. Considerable training of personnel for proper setup and monitoring

Assessment of Outcome:
1. Improvement of PH
2. Improvement of CO2 value
3. Improvement of PO2 value/ O2 saturation
4. Decrease in work of breathing/ accessory muscle use
5. Improvement of respiratory rate and pattern
6. Improvement of chest radiograph
7. Tolerance of procedure/mask
8. Improved hemodynamic status
9. Resolution of primary indication for implementation

****Strongly Consider Intubation within 24 hours of implementation if:
*(Also, intubation must be reconsidered at anytime where there is a change in Patient status/indications/contraindications)
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1. Respiratory rate persistently >40 bpm
2. Heart Rate Increasing
3. Work of breathing remains increased with accessory muscle use noted
4. Poor patient/ventilator synchrony
5. PaO2 <60 mmHg or O2 saturation <90% on >60% FiO2
6. Increased CO2, with decreasing pH
7. Patient Comfort level unacceptable

**** Intubation necessary if patient requiring continuous NIV >48 hours

Resources:

Equipment:
1. Ventilator (NIV software when available)
2. Properly fitted NIV mask with straps (nonvented)
3. Artificial skin when indicated (Duoderm)

Personnel:
Respiratory Therapist due to ability to:
1. Properly use and identify the limitations of equipment
2. Assess patient condition, response to therapy and tailor therapy to meet patient needs
3. Perform a physical examination
4. Understand the effects of increased expiratory pressure on ventilation, perfusion, cardiac function
5. Understand the procedures, indications, contraindications and hazards
6. Monitor effects of subject response
7. Understand and comply with Universal precautions and infection control standards related to cleaning equipment and maintaining equipment
8. Negotiate care plan and modifications with physician and health care team
9. Instruct patient concerning the goals of therapy
10. Modify therapy in response to adverse reactions

Monitoring:
The following should be monitored in addition to the parameters normally monitored with patients requiring mechanical ventilation:
1. Patient comfort
2. Mask fit/leakage
3. Facial breakdown (nasal bridge)

Weaning:
Weaning may be accomplished either by progressively decreasing the levels of positive airway pressure or by decreasing the therapy for increasing lengths of time. A combination of both strategies can be utilized.
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References:

1. AARC Clinical Practice Guideline
   Management of Airway Emergencies
   Respiratory Care 1995; 40(7): 749-760
2. Sat Sharma, MD, FRCPC: Ventilation Non-invasive
   www.emedicine.com/med/topic_3371.htm
3. Nicholas S Hill MD, Tufts- New England medical Center, Boston, MA
   Protocol for Noninvasive Positive Pressure Ventilation
4. Gumersindo Gonzalez Diaz, MD; Andres Carrillo Alcaraz, MD; Juan Carlos Pardo Talavera, MD; Pedro
   Jara Perez MD; Antonio Esquinas Rodriguez, MD; Francisco Garcia Cordoba, MD; and Nicholas S Hill,
   MD, FCCP
   Noninvasive Positive-Pressure Ventilation to Treat Hypercapnic Coma Secondary to Respiratory Failure.
   Chest 2005; 127: 952-962