PURPOSE:

In general, MedEvac will transport patient's needing prone positioning but additional patient and transport logistic assessments need to be performed prior to transport. Considerations will be made if patient is best served with transport via MedEvac versus transport teams affiliated with destination hospital if ECMO is a treatment consideration.

STAKEHOLDERS:

MedEvac Medical Transport

PROVISIONS:

I. Indications

A. "Prone ventilation" refers to the delivery of mechanical ventilation with the patient lying in the prone position. Prone ventilation is NOT considered a mode of mechanical ventilation. Volume-controlled and pressure-controlled modes of ventilation are the typical modes of ventilation that are delivered in the prone position.
B. In the last few years, prone positioning has been used increasingly in the treatment of patients with acute respiratory distress syndrome (ARDS). This maneuver is now considered a simple and safe method to improve oxygenation with the increasing use in COVID-19 patients. However, the physiological mechanisms causing respiratory function improvement as well as the real clinical benefit are not yet fully understood. The aim of this review is to discuss the physiological and clinical effects of prone positioning in patients with ARDS.
C. Severe ARDS defined as PaO2: FiO2 ratio < 150 mmHg with a FiO2 > 0.6 and PEEP > 5 cm H20.
D. Refractory hypoxemia due to ARDS defined as PaO2: FiO2 ratio < 100 mmHg with a PaO2 < 60 mmHg despite optimization of the ventilator settings on FiO2 of 1.0.

II. Contraindications

A. Shock (e.g. persistent mean arterial pressure < 65 mmHg).
B. Acute bleeding (e.g. Hemorrhagic shock, massive hemoptysis).
C. Multiple fractures or trauma (e.g. unstable fractures of femur, pelvis, face).
D. Spinal instability.
E. Pregnancy.
F. Raised intracranial pressure > 30 mmHg or cerebral perfusion pressure < 60 mmHg.
G. Tracheal surgery or sternotomy within two weeks.

III. Relative contraindications

A. Recent DVT treated for < 2 days.
B. Anterior chest tube(s) with air leaks.
C. Major abdominal surgery.
D. Recent pacemaker.
E. Clinical conditions limiting life expectancy (e.g. oxygen or ventilator-dependent respiratory failure).
F. Severe burns.
G. Lung transplant recipient.
H. Prior use of rescue therapies.

IV. Complications

A. Nerve compression (e.g., brachial plexus injury).
B. Crush injury.
C. Venous stasis (e.g., facial edema).
D. Dislodging endotracheal tube.
E. Diaphragm limitation.
F. Pressure sores (e.g., facial).
G. Dislodging vascular catheters or drainage tubes.
H. Retinal damage.
I. Transient reduction in arterial oxygen saturation.
J. Vomiting.
K. Transient dysrhythmias.

V. Procedure-Dispatch

A. Upon transport request being received for a patient requiring prone positioning, dispatch will first determine clinical situation surrounding prone positioning.
    i. Prone positioning only: Prone positioning for optimization of oxygenation but not requiring non-invasive positive pressure ventilation (NIPPV).
    ii. Prone positioning with NIPPV:
        a. Is prone positioning intermittent or needs to be continuous to maintain adequate oxygenation?
        b. Is patient able to assist with repositioning prone to supine?
    iii. Prone positioning and intubation:
        a. How long has patient been intubated?
        b. Is prone positioning intermittent or needs to be continuous to maintain adequate oxygenation?
B. Transport Asset Assignment
    i. Prone positioning only: Assess distance of transport and patient mobility in determining crew configuration.
    ii. Prone positioning with NIPPV: Critical Care Crew.
    iii. Prone positioning and intubation
        a. Intermittent Prone Positioning: Critical Care Crew
        b. Continuous Prone Positioning: Consideration for pre-transport initiation of ECMO and/or transport by ECMO equipped transport team.

VI. Prone Position Transport Risk-Benefit Documentation:

MedEvac personnel will ensure the following information has been discussed with the patient/representative and documented by the transferring physician on the EMTALA transfer form.

A. Transport of a patient in the prone position introduce inherent limitations of treatment secondary to position.
B. In the event of cardiac arrest, chest compressions will either be posterior "chest" compressions **OR** the patient needs to be placed in the supine position prior to initiation of chest compressions which will delay time to initiation of chest compressions.
C. Displacement or other complications with endotracheal tube will require patient being placed in supine position prior to initiation of airway management which may increase period of hypoventilation and hypoxia.
D. If patient being transported via helicopter: helicopter will need to initiate emergency landing prior patient being able to be moved from prone to supine position, further delaying needed interventions.
E. Clarification of Code Status.
F. Recommended wording: **Risk of transport in prone positioning including delay of initiation of treatment including airway management and chest compressions has been discussed with the the patient/patient's decision maker and risks are understood**

VII. Pre-Transport Briefing:

Prior to transport of a intubated patient in the prone position, the transport crew should discuss patient and planned treatment course with Medical Control, if possible transferring and/or accepting physician(s) should participate in briefing.

VIII. Transport Considerations

A. If patient is currently being treated with intermittent prone positioning and has recently been in the prone position, preference is to transport the patient in the supine position.
B. If patient is not currently tolerating supine positioning and therefore must be transport in the prone position, then the protocol below should be followed.

IX. Transfer of an Already-Proned Patient to the Transport Stretcher

A. The move from the bed to the transport stretcher/sled should be slow and controlled with hospital personnel assisting the transport team and should not be attempted with less than 4 individuals.
B. Verify tracheal tube, invasive lines, and any catheters are firmly secured.
C. Verify all tubing is long enough to move the patient.
D. Have intubation equipment ready to include but not limited to: Bougie, alternate airway, and surgical airway kits.
E. Set up the transport ventilator for immediate connection to the patient following the move.
F. Assure inline suction available on ventilator tubing.
G. Place sheet under patient folded noting enough material to rotate patient supine if needed in emergent situation. (see https://videopress.com/v/TE80TNl4).
H. Consider sedation and analgesia prior to moving patient.
I. Use a slide board and sheet to move the patient to the transport stretcher.
J. Qualified personnel managing the patient's airway at the patient's head shall be holding the tracheal tube along with supporting the chin, nose, and forehead. There also may exist the need to tip the patient slightly to side to prevent the tracheal tube from kinking during the move. Personnel handling the airway shall verbally coordinates the move and has no other responsibility during the move from the bed to the transport stretcher/sled.
K. Consider applying a cervical collar to assist with stabilization of airway.
L. Make sure eyes are closed and lids taped down to prevent corneal abrasion when moving over to stretcher/sled.
M. Maintain any padding with pillows/blankets/towels to the patient's head, shoulder, and hips if abdomen is large. If hospital has been using a foam donut-style pillow, take with you for transport.
N. Clamp the endotracheal tube at the end of inspiration immediately before moving the patient from the bed to the transport stretcher/sled.
O. Move the patient.
P. Un-clamp the tracheal tube and attach the transport ventilator.
Q. Assess breath sounds and ETCO2 for possible dislodgement or misplacement of the tracheal tube.
R. Assess and adjust all tubing and lines for connections and functions.
S. Suction the tracheal tube as needed
T. No tubing, monitoring cables, or other lines should be under patient after move to transport stretcher/sled.
U. The ECG pads should be posterior.
V. Check to make sure ear is not folded and pinned. Make sure there is no pressure on eyes.
W. Secure to transport stretcher/sled with shoulder straps as well as two cross straps at the hips and legs as for every transport.
X. Monitor mechanical ventilator for minute ventilation and tidal volume (inhaled vs exhaled).
Y. If you have to rotate the patient supine in emergent situation, you will need to tuck the dependent arm under the thorax or raise arm in cocked position over the head so it does not interfere with lateral roll.

Z. If patient condition requires repositioning to supine during transport, discuss with team to emergently land for this maneuver.

X. Ventilator Strategy

The delivery of invasive mechanical ventilation in the prone position is similar to that employed when the patient is supine. For patients with ARDS, this is typically a ventilation strategy that incorporates low tidal volumes (4 - 6 mL/kg) and high PEEP in comparison to FiO2;

A. Peak inspiratory pressure and plateau pressure may increase immediately after a patient is placed in the prone position or moved, but typically decline with time.
B. The initial increase is likely related to decreased chest wall compliance and the mobilization of secretions, while the subsequent decrease is probably due to progressive alveolar recruitment.
C. The tracheal tube may need suctioning with increased frequency after the patient is placed prone or moved as large quantities of pulmonary secretions may drain into the tracheal tube.

XI. Sedation and Paralysis:

All patients for which prone ventilation is performed require increased sedation and analgesia. Most will require neuromuscular blockade.

XII. Patient Decompensation:

A. If the patient suffers cardiac arrest, displacement or other complications with endotracheal tube, patient should be moved to supine position as soon as safely feasible.
    i. This may require an emergency landing of the aircraft or stopping of the ground ambulance.
    ii. Until patient can be placed supine, maximize treatments available in the prone position.
        a. From American Heart Association Interim Guidance for Basic and Advanced Life Support in Adults, Children, and Neonates With Suspected or Confirmed COVID-19:
            i. Although the effectiveness of CPR in the prone position is not completely known. For those patients who are in the prone position with an advanced airway, it may be reasonable to avoid turning the patient to the supine position unless able to do so without risk of equipment disconnections and aerosolization.
            ii. If unable to safely transition the patient to a supine position, **place the defibrillator pads in the anterior-posterior position** and provide CPR with the patient remaining prone with **hands in the standard position over the T7/10 vertebral bodies.**
            iii. Do NOT utilize the Lucas Chest Compression device when the patient is in a prone position.

REFERENCES:

Emergency Cardiovascular Care Committee and Get With The Guidelines-Resuscitation Adult and Pediatric Task Forces of the American Heart Association. (2020, April). Interim Guidance for Basic and Advanced Life Support in Adults, Children, and Neonates With Suspected or Confirmed COVID-19. *Circulation, 141*(25), e933-e943. doi:https://doi.org/10.1161/CIRCULATIONAHA.120.047463

DESIRED PATIENT OUTCOMES:

Therapeutic Goal: To improve the respiratory physiology of patients with acute respiratory distress syndrome (ARDS), among other conditions, by transporting the patient prone while on the mechanical

ventilator, specifically to:

A. Improve oxygenation.
B. Improve respiratory mechanics.
C. Homogenize the pleural pressure gradient, the alveolar inflation, and the ventilation distribution.
D. Increase lung volume and reduce the amount of atelectatic regions.
E. Facilitate the drainage of secretions.
F. Reduce ventilator-associated lung injury.

EQUIPMENT:

A list of all essential equipment required to perform the **procedure**.