

Prone Positioning

DALHOUSIE SHS

Objectives

- Define ARDS
- Describe categories of severity of ARDS
- Explain the physiology of prone ventilations
- Describe the possible benefits of prone ventilation in the ARDS patient
- Describe the indications and exclusion of prone ventilation
- Describe the procedure of proning and caring for proned patient
- Explain when and how to discontinue proning

ARDS



Adult Respiratory Distress Syndrome

- First described in 1967
- Acute Respiratory Distress Syndrome
- Severe, acute lung injury involving diffuse alveolar damage, increased microvascular permeability and non cardiogenic pulmonary edema
- Acute refractory hypoxemia
- Results from various etiologies caused by DIRECT and IN-DIRECT injuries
- Mortality remains 35-46% despite research and improvements in management (Fan et al, JAMA, 2018)

ARDS – Berlin definition (2012)

- Onset of ARDS must be acute, defined as within 7 days of some defined event, which may be sepsis, pneumonia, or worsening respiratory symptoms.
 - Most cases of ARDS occur within 72 hours of recognition of the presumed trigger.
- Bilateral opacities consistent with pulmonary edema; may be detected on CT or CXR.
- Do NOT need to exclude heart failure; respiratory failure “*not fully explained by cardiac failure or fluid overload,*”
 - “**objective assessment**” – meaning an **echocardiogram** in most cases — should be performed if there is **no clear risk factor** present like trauma or sepsis.

ARDS – Berlin definition (2012)

ARDS Severity	PaO ₂ /FiO ₂	Mortality
Mild	200-300	27%
Moderate	100-200	32%
Severe	<100	45%

Risk Factors for ARDS

DIRECT

- pneumonia
- Aspiration of Gastric contents
- Inhalation Injury
- Pulmonary Contusion
- Pulmonary Vasculitis
- Drowning

INDIRECT

- Non-pulmonary Sepsis
- Major Trauma
- Pancreatitis
- Severe Burns
- Non-cardiogenic Shock
- Drug Overdose
- Multiple transfusions or Transfusion Associated Acute Lung Injury (TRALI)

Physiology: ARDS

Dorsal/dependent regions are more susceptible to **decreruitment** in supine position due:

- Pressure exerted by the heart
- Pressure by lung mass
- Accumulation of fluid in pleural space
- Pressure exerted by abdominal contents (in patients who have lost diaphragmatic tone)
- High lung compliance in nondependent region

Consequence is uneven alveolar filling with **VQ mismatch**

Physiology: Prone

- Prone position results in more even alveolar ventilation :
 - Infiltrates redistribution
 - Reduced compression of the lungs by the heart and lung
 - Decreased lung compliance in nondependent region
 - Less pressure from abdominal contents
 - Facilitates drainage of secretions
- Blood flow pattern does not change significantly.

VQ matching therefore improves

Why proning could be beneficial in ARDS

- A shift downward of the diaphragm takes abdominal contents away from the dependant lung zones → greater lung expansion and increased FRC
- A shift of water and exudates from dependant to non-dependant regions → drainage of secretions is enhanced
- Transpulmonary pressure exceeds airway pressures in dorsal lung regions
- Alveolar recruitment strategy

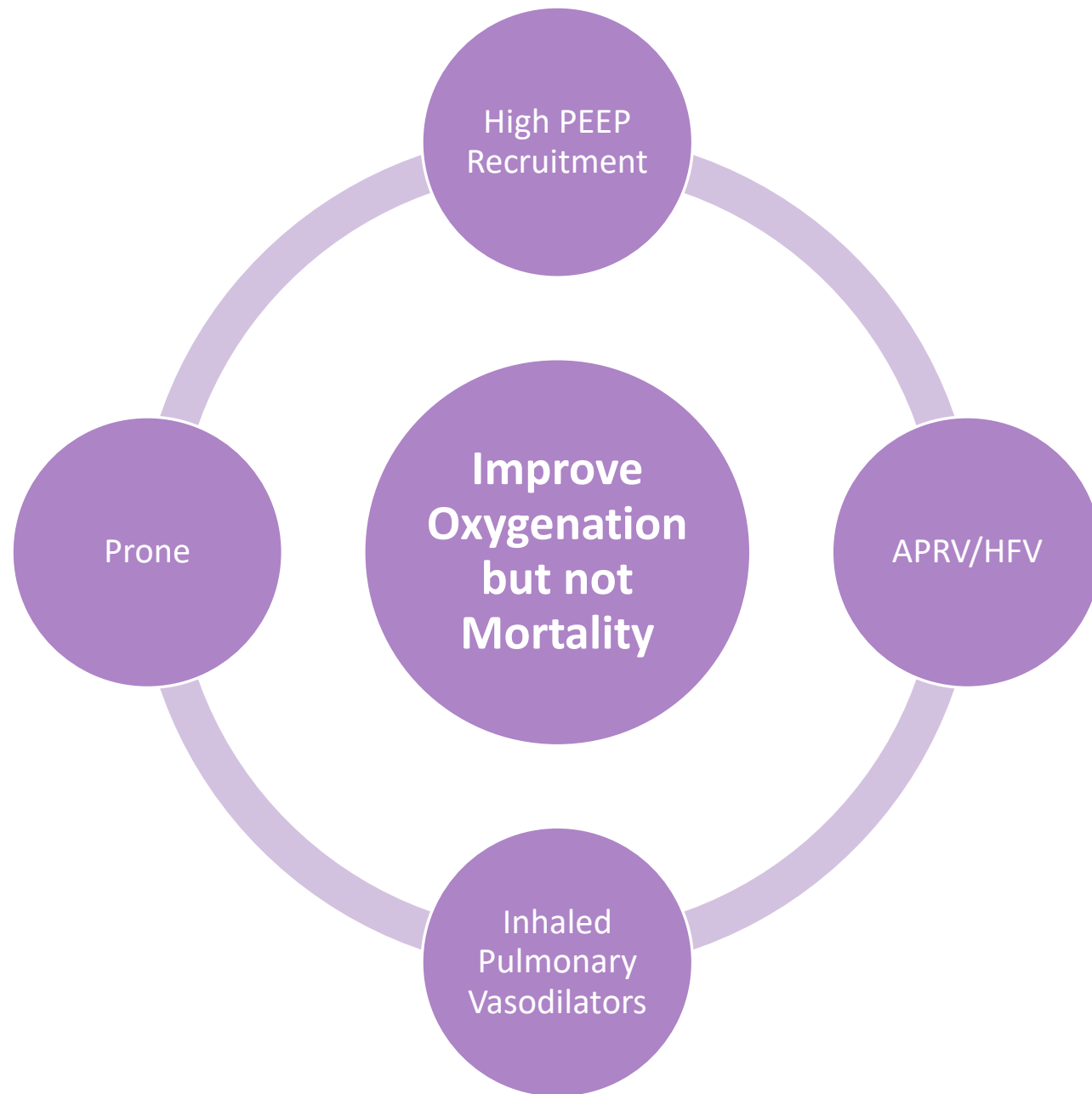
Effect of Prone on Oxygenation

6 randomized controlled trials prior to 2013

- All demonstrated improvements in oxygenation with prone
- But none showed statistical difference in mortality

Found :

- Response time short
- Improvements in oxygenation usually persistent
- Most likely to respond: increased intraabdominal pressure, lower lung compliance in prone, dependent alveolar collapse, extra-pulmonary ARDS



Indications for Prone Ventilation

- ARDS (P/F ratio less than 150 at NSHA)
- Other: pressure ulcers or nursing related issues

Relative Exclusions or Cautions

- Elevated ICP
- Intestinal ischemia
- Known difficult airway
- Obesity
- Recent abdominal incisions
- Breast Implants
- Penile prosthesis
- Peritoneal dialysis

Complications

- Unplanned extubation
- Selective intubation into a main bronchus
- Endotracheal tube obstruction
- Loss of venous or arterial access
- Facial and airway edema *
- Pressure ulcers *
- Thoracotomy tube dislodgement or kinking
- Hypotension and arrhythmias

***No difference in adverse events in PROSEVA trial, complications likely related to a lack of familiarity /experience with the procedure**

Procedure

Prepare the patient

- Provide eye care by inserting drops/lubricating gel; tape shut and pad with eye patches to decrease the likelihood of corneal abrasions.
- Secure lines (central, pulmonary or arterial catheters, IV's), feeding tube, drains, tubing and catheters if present.
- Remove all ECG pads
- Secure the endotracheal and tracheostomy tubes using holders
- Ensure all are secured.
- If possible have the patient NPO prior
- Consider sedation

Procedure

Placing the Patient in the Prone Position:

- Place lines in the midline position, either running to the head or to the feet. Cap off as many lines as possible.
- RRT preoxygenate the patient prior to proning.
- Ensure someone capable of intubation if accidental extubation occurs
- Turn the patient's face away from ventilator. Position the endotracheal tube (ETT) on the side of the mouth furthest from ventilator.

Note: The person managing the airway must say “All Ready” when initiating moving the patient.

Procedure

- Slide the patient over to the edge of the mattress away from the ventilator.
- Tilt the patient fully on to their side and insert pillows under lower legs, chest and pelvis to maintain an unrestricted abdomen.
- The patient is then **TURNED** to the **PRONE** position **TOWARDS VENTILATOR**.

Prone Care

Once prone

- Auscultate bilaterally and place EKG pads on the back of the patient.
- Place a proning pillow under the head with head in a neutral position.
 - Ensure the eyes are in a free space
 - Head is supported, with the neck in a neutral position
 - Ears are not compressed or folded
 - Nose is free from pressure
- Bed in a slight reverse Trendelenburg so eyes are above the right atrium(venous drainage and decrease edema)
- Place the patient's arms at their sides with palms up or in the swimmers position
 - Alternate the arm position every 2 hours.
- Do not use rotation mode on air flow bed when in prone position.

Discontinuation of Proning

WHEN?

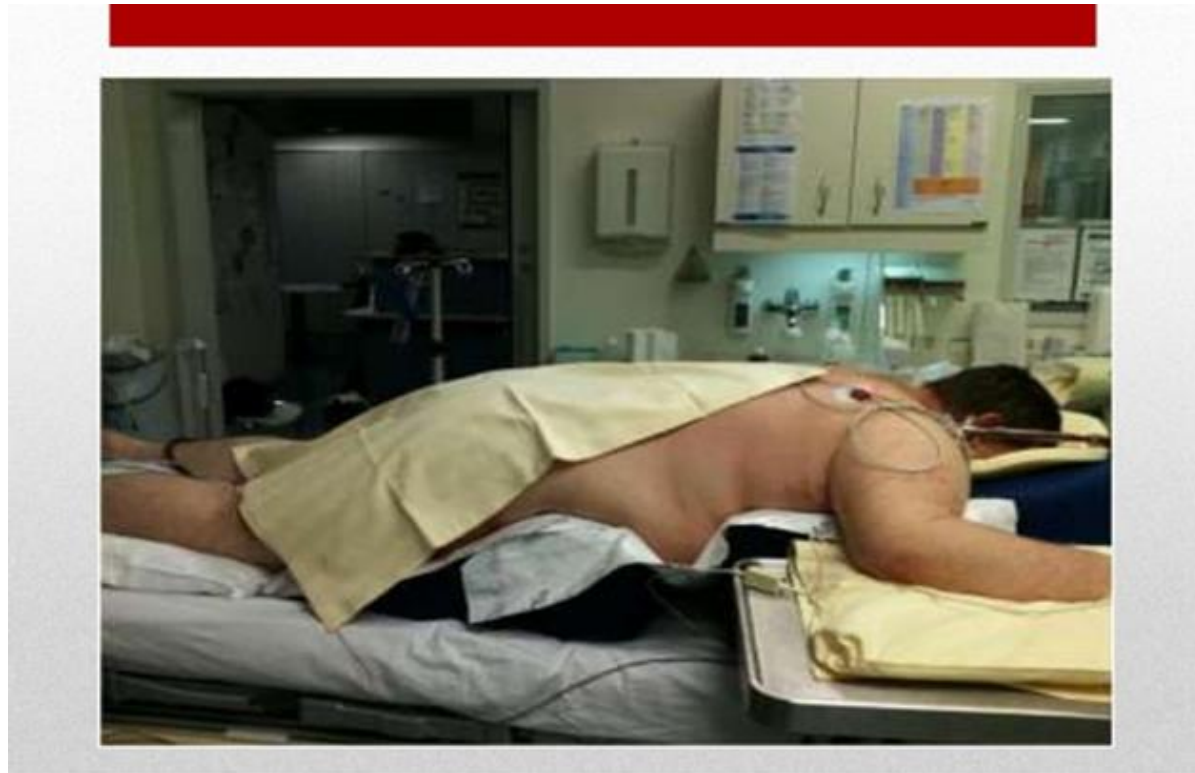
- Length of prescribed time reached (limited to between 12 to 20 hours per session)
- The patient becomes hemodynamically unstable
- The patient has a worsening respiratory status

HOW?

- To return to supine, follow proning procedure in the reverse

Prone Positioning

PRONE Positioning



Pillow Formation



Side Roll



Swimmer's Position



Side View

