1. INTRODUCTION

1.1. The high mortality and the complexity of treatment of acute respiratory distress syndrome (ARDS) has claimed the attention of clinicians and researchers .Most of the treatment modalities have focused on reversing hypoxemia and maintaining lung protective strategies in which prone positioning of patient gained popularity.

1.2. Prone positioning is a therapeutic maneuver to improve oxygenation and pulmonary mechanics in patient with acute lung injury or ARDS. Ventilation in the prone position is widely used to improve pulmonary gas exchange in ARDS and has been established as safe in adults. A study suggests that patients with ARDS who respond to prone positioning with a reduction in their PaC02 show an increased survival at 28 days. Mancebo et.al, find out that patients with ARDS who received mechanical ventilation in the prone position within 48 h of meeting entry criteria, and who remained prone for most of the day and until preset weaning criteria were met, had a 15% absolute and a 25% relative reduction in intensive care unit mortality compared with those who were ventilated supine. More recent study found that early prone positioning for patients with ARDS improve mortality. Hence, using prone ventilation for prolonged periods of time is both feasible and safe and may reduce mortality in ARDS patients.

2. PURPOSE

2.1. POSSIBLE MECHANISMS OF IMPROVED OXYGENATION/VENTILATION:

2.1.1. Re-expansion of lung that is collapsed by the weight of edematous lung above.

2.1.2. Offloading the mediastinal structures from the lung beneath.

2.1.3. Increased trans-pulmonary pressure opens collapsed alveoli in the previously dependent areas.

2.1.4. Better distribution of blood through the lungs.

2.1.5. Increased functional residual capacity.

2.1.6. Less atelectasis in dependent regions than in the supine position.

2.1.7. Better mobilization of chest secretions.

3. POLICY

3.1. CRITERIA FOR PRONING POSITION:

3.1.1. Acute onset of respiratory failure associated with:

3.1.1.1 Radiological evidence of diffuse bilateral pulmonary infiltrates
3.1.1.2 No clinical evidence of Left Atrial Hypertension or PAWP< 18mmHg

3.1.2. Severe Hypoxemia- associated with ratio of arterial partial pressure of O_2 to fraction of inspired $O_2 \leq 100$.

3.2. CONTRAINDICATION FOR PRONING POSITION:

3.2.1. Increase intra cranial pressure / Head injury.
3.2.2. Spinal injury.
3.2.3. Unstable bone fractures.
3.2.4. Multiple trauma.
3.2.5. Shock.
3.2.6. Abdominal compartment syndrome
3.2.7. Extremely obese patient weight of ≥ 135 Kg / Morbid obesity.
3.2.8. Patient weight ≤ 40 Kg.
3.2.9. Patient Height in excess of 6 ft 6 inches.
3.2.10. Acute bleeding.
3.2.11. Recent abdominal surgery or injury.
3.2.12. Maxillofacial surgery.
3.2.13. Kyphoscoliosis.
3.2.14. Patient with traction.
3.2.15. Pregnancy 2nd / 3rd Trimester.
3.2.16. Unstable cervical, thoracic, lumbar, pelvic, skull and facial fracture.
3.2.17. Hemodynamic instability with MAP ≤ 60 mm Hg and Systolic blood pressure of ≤ 90 mm Hg regardless of fluid and inotropic support.
3.2.18. Anterior burns, chest tubes and open wounds.
3.2.19. Frequent seizure.
3.2.20. Recent tracheostomy < 24hours.

3.3. RISKS AND PRECAUTIONS:

3.3.1. Skin Breakdown and necrosis
3.3.2. Wound dehiscence
3.3.3. Cardiac arrest
3.3.4. Loss of invasive line/tubing's, extubations
3.3.5. Edema or swelling
3.3.6. Spleenic rupture
3.3.7. Blindness and other consequences of damage to the ocular nerve
3.3.8. Venous air embolism
3.3.9. Central retinal artery occlusion

3.3.10. Pain and discomfort

3.3.11. Difficulty in performing CPR

3.4. INDICATION FOR PRONING DISCONTINUATION

3.4.1. Duration of prone position (for safety reasons, average of 16 -18 hours).
3.4.2. The patient becomes hemodynamically unstable.
3.4.3. The patient has a worsening respiratory status.
3.4.4. Improve oxygenation and ventilation.

4. PROCEDURE

4.1. BEFORE PRONING

4.1.1. Identify the Patient. (Refer to Patient Identification Policy, 1-1-8062-01-011).
4.1.2. Multidisciplinary discussion regarding the potential risks and benefits of prone ventilation. A physician order will be done and verified.
4.1.3. Ensure no contraindications.
4.1.4. Inform and counsel patient/relatives.
4.1.5. Ensure adequate numbers of staff available to facilitate safe procedure. A minimum of 5 staff wherein one staff in the head part and 2 staff in each side of the bed.
4.1.6. Complete essential interventions.
4.1.7. Ensure the team has considered any outstanding investigations, procedures and necessary transfers that would prove to be difficult to perform once the patient is prone.
4.1.8. Ensure that the brake of the bed is engaged.
4.1.9. **Airway/Breathing**

4.1.9.1. Ensure availability and functionality of resuscitation bag with external PEEP valve.
4.1.9.2. Secure airway (re-intubation equipment available).
4.1.9.3. Suction oropharynx and airway prior to procedure.
4.1.9.4. Ensure closed circuit suctioning is available and working throughout.
4.1.9.5. Patient should be pre-oxygenated with 100% O_2 and ensure appropriate ventilator settings. Note tidal volume and inspiratory pressure.
4.1.9.6. Pre-proning arterial blood gas should be taken (2hours prior to proning) and document results.

4.1.9.7. Minimize ventilator disconnection as possible to avoid lung de-recruitment.

4.1.10. **Cardiovascular**

4.1.10.1. Patient should be cardiovascular stable.

4.1.11. **Neuro**

4.1.11.1. Patient should be receiving adequate sedation and analgesia.
4.1.11.2. Consider muscle relaxation (Bolus dose may be required).

4.1.12. **Skin/Eyes**

4.1.12.1. Wounds should be assessed and redressed.
4.1.12.2. Eye Care/padding.

4.1.13. **Tubes/Lines**

4.1.13.1. Discontinue non-essential infusions.
4.1.13.2. Nasogastric feed should be stopped, and the nasogastric tube aspirated (ideally at least 1hr before proning).
4.1.13.3. Adjust and secure all IV tubing /lines to prevent dislodgement, kinking, disconnection or in contact with the patient body during the turning and while patient on prone position.
4.1.13.4. Place all tubing/lines inserted in the upper torso over the right or left shoulder, with the exemption of chest tubes which needs to be well secured and placed below the patient. Always turn the patient in the direction of the mechanical ventilator.
4.1.13.5. Urinary catheter should be taped to the inside of the leg.
4.1.13.6. Secure the dialysis line if applicable.
4.1.13.7. Secure the peripheral lines if applicable.
4.1.13.8. Remove ECG electrodes.

4.1.14. **General**

4.1.14.1. Daily hygiene addressed as, mouth care, washing, dressing, changing of stoma bags (if applicable).
4.1.14.2. Ventilator as close to the patient as possible on the appropriate side.

4.1.15. **Equipment**

4.1.15.1. Pillows.
4.1.15.2. Bed sheets.
4.1.15.3. Foam Dressing for protection.
4.1.15.4. Gel mat or doughnut ring to relieve facial pressure.

4.1.16. **PREPARATION**

Careful preparation is essential to ensure patient and staff safety. The prone position has the potential to cause harm to the patient as well as benefit. The most common serious adverse events are due to pressure areas, endotracheal obstruction or unanticipated extubation.

4.1.16.1. Ensure prone ventilation is indicated. Consider using muscle relaxants – there is evidence that an infusion of muscle relaxant in the early stage of ARDS reduces barotrauma and may decrease mortality.
4.1.16.2. Decide which way to turn the patient
4.1.16.3. Complete essential interventions
4.1.16.4. Check line placements/apply padding over lines
4.1.16.5. Aspirate NG tube
4.1.16.6. Oral care
4.1.16.7. Secure airway (re-intubation equipment available)
4.1.16.8. Wounds assessed and redressed
4.1.16.9. Eye care/padding
4.1.16.10. Remove ECG electrodes
4.1.16.11. Apply closed suction
4.1.16.12. Ensure adequate sedation/paralysis/adequate pain management
4.1.16.13. Pre-oxygenate patient with 100% O_2 for approx. 10 mins.
4.1.16.14. Ensure that the brake of the bed are engaged
4.1.16.15. Position staffs appropriately a minimum of 5 staff in manual prone position. One staff in the head part and 2 staff in each side of the bed.
4.1.16.16. Respiratory therapist will be on the head part of the patient he/ she will be responsible for the airway and ventilator tubing's. Special attention to endotracheal tube.
4.1.16.17. Adjust and secure all IV tubing's / lines to prevent dislodgement, kinking, disconnection or in contact with the patient body during the turning and while patient on prone position.

4.2. PRONING PROCEDURE

4.2.1. RT controls the head and airway and directs the turn with two to three additional staff members on either side of the patient

4.2.2. RT issues the command to turn throughout the procedure.

4.2.3. ICU Physician oversees the whole process and ensures safety.

4.2.4. Pre-oxygenate the patient with 100% FiO_2 prior to turning.

4.2.5. Ensure all essential lines/catheters above the waist are safely secured and directed towards the patients' head.

4.2.6. Chest drains and urinary catheters are directed towards the patient's feet.

4.2.7. Ensure that the patients' arms are positioned close to their sides with the palms facing inwards.

4.2.8. The bottom sheet underneath the patient must be pulled straight and taut and a second sheet is laid on top of the patient ensuring that all corners are matching.

4.2.9. The patients head and face are then uncovered and the staff on either side should proceed to roll the matching edges of the sheet together tightly, effectively cocooning the patient inside.

4.2.10. The patient has been secured and it is safe to proceed, the patient should be glided across the bed in the supine position, away from the ventilator, to as near the edge of the bed as is safely possible.

4.2.11. Whilst maintaining a tight hold on the rolled-up sheet edges and affording all staff the opportunity to swap over supporting hands, the patient should then be primarily maneuvered into the lateral position facing the ventilator.

4.2.12. At the lateral position, ensure lines, catheters and tubes are free of tension.

4.2.13. Pillows should be then placed across the bed adjacent to the patient's chest and pelvis.

4.2.14. The patient is then lowered carefully towards the ventilator onto the supporting pillows and into the prone position.

4.2.15. The patient can be lifted by the rolled-up sheet edges into a more central position in the bed and detailed consideration can be given to the exact position of the supporting pillows. The lower sheet should be pulled taut to prevent skin injury in the prone position.

4.2.16. When the patient is in the prone position, position the head to the side, initially facing the ventilator. A pad can be placed under the face to collect draining oral and pharyngeal secretions.

4.2.17. Arms are placed in a 'swim' position: the arm that the patient is facing is flexed at the elbow, so the hand is palm down and parallel to the patient's face.

4.2.18. The other arm is partially extended along the body with the palm up. The upper pillow(s) must adequately support the patient's chest, allowing their shoulders to fall forward slightly and reducing the risk of over distension of the anterior capsule of the shoulder joint and injury to the brachial plexus.

4.2.19. The lower pillow should be positioned under the patients' pelvis, to allow diaphragmatic and abdominal excursion. Ensure that the abdomen is not resting upon the hard surface of the bed. A hand should be able to pass under the abdomen freely.

4.2.20. The patient should be nursed at 30° in the reverse Trendelenburg position.

4.3. AFTER PRONING

4.3.1. Ensure the ETT is not kinked .Check ETT cuff pressure and placement.

4.3.2. Reattach the ECG electrodes and ensure all monitoring is re-established. Continuously monitor vital signs including oxygen saturation and for signs of worsening respiratory status.

4.3.3. Take Arterial Blood Gas (ABG) after 20 minutes and compare with pre-proning ABG.

4.3.4. Reassess the position and function of all lines and tubes.

4.3.5. Reposition and recalibrate all pressure transducers.

4.3.6. Reassess the need for sedation/analgesia.

4.3.7. Assess patient's tolerance to the turning procedure using physical cues such as respiratory rate and effort, heart rate or blood pressure. If these parameters fail to return to baseline within 5 minutes of the turn, the patients may be displaying initial signs of intolerance.

4.4. RETURNING TO SUPINE POSITION

4.4.1. RT control the head and airway and directs the turn with two to three additional staff members on either side of the patient.

4.4.2. Pre-oxygenate the patient with 100% FiO_2 prior to turning.

4.4.3. Ensuring all essential lines are safely secured and directed towards the patient's head or feet.

4.4.4. Ensure that the patients' arms are positioned close to their sides with the palms facing inwards.

4.4.5. The bottom sheet is pulled straight and taut and a new top sheet laid across the patient ensuring that all corners are matching.

4.4.6. The patients head and face are then uncovered and the staff on either side should proceed to roll the matching edges of the sheet together tightly, again effectively cocooning the patient inside.

4.4.7. Once the patient has been secured and it is safe to proceed, the patient should be glided across the bed, towards the ventilator, to as near the opposite edge of the bed as is safely possible.

4.4.8. Whilst maintaining sheet integrity and affording all staff the opportunity to swap over supporting hands, the patient should then be primarily maneuvered into the lateral position.

4.4.9. At the lateral position, ensure lines, catheters and tubes are free of tension.

4.4.10. Pillows adjacent to the patient's chest and pelvis are then removed.

4.4.11. The patient is then lowered carefully towards the ventilator and back into the supine position.

4.5. SPECIAL INSTRUCTIONS

4.5.1. In case of cardiac arrest, start CPR in prone position. Turning is done when the team is assembled to perform supine positioning.

4.5.2. Ensure the abdomen is not compressed: a hand should be able to pass under the abdomen freely.

4.5.3. Patients may require increased sedation/muscle relaxants to tolerate prone positioning. Perform hourly pupil checks.

4.5.4. Avoid extension, flexion or lateral rotation /flexion of the spine. All joints the should be in a neutral anatomical position.

4.5.5. Patients with short necks and limited range of neck motion have difficulty assuming a side lying head position. Therefore, these patients are more prone to facial skin breakdown and it may be necessary to turn the patient more frequently to prevent skin breakdown.

4.6. DOCUMENTATION

4.6.1. Date and Time of Proning.

4.6.2. Duration time of Proning.

4.6.3. Vital signs, Oxygen Saturation and pain level.

4.6.4. Patient's response to therapy, ability to tolerate the turn length of time in the prone position.

4.6.5. Any complications noted during or after the procedure.

5. REFERENCES

5.1. Beer, Johan M., The use of the prone position in mechanically ventilated patients with Acute Respiratory Distress Syndrome, Dissertation for Advanced Trainee in Intensive Care Medicine, Bristol Rotation, February 2005.

5.2. JordiMancebo, et.al. "A Multicenter Trial of Prolonged Prone Ventilation in Severe Acute Respiratory Distress Syndrome", American Journal of Respiratory and Critical Care Medicine, Vol. 173, No. 11 (2006), pp. 1233-1239.

5.3. Harcombe C (2004) Nursing patients with ARDS in the prone position. Nursing Standard. 18, 19, 33-39. Date of acceptance: November 11 2003.

5.4. Hudack, Michael, Nursing Critical Care: Prone positioning for patients with ARDS. March 2012 - Volume 7 - Issue 2 - p 20–24

5.5. Lippincott Nursing Procedure Book 4th edition

5.6. Albert.R.K. 1993 New ideas in treatment of ARDS Proceeding of the European Society on Intensive Care March 1993 Brussels

5.7. Albert RK.1994. One good Turn. Intensive Care Med.

5.8. Davis JW, LeMaster DM, Moore EC, et al. Prone ventilation in trauma or surgical patients with acute lung injury and ARDS: is it beneficial? J Trauma. 2007; 62(5):1201–1206.

5.9. Bolton NHS Foundation Trust, 2012. Guidelines for Prone Positioning in Critical Care. Retrieved August 5, 2013 from arnotsmith.files.wordpress.com/2012/09/prone-guideline.doc.

5.10. Beckenham, Mary. 2010. NHS Trust Clinical Guidelines: Local Adult Critical Care Guidelines for Turning Patients into The Prone Position. Nottingham University Hospital, pp. 1-17.

5.11. Ministry of Health. (2020, June 13). *Use of Positioning in Adult with COVID-19 Respiratory Failure*. www.moh.gov.sa

5.12. Joint Commission International (2020).*Joint Commission International Accreditation Standards for Hospitals (7th Ed). Facility Management and Safety.* Joint Commission Resources, Ork Brook, Illinois 60523.

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