وزارة الصحة
Ministry of Health

Use of Prone Positioning in Adult with COVID-19 Respiratory Failure

1. Introduction

1.1. Background

Coronavirus disease 2019 (COVID-19) is a novel strain of the coronavirus family since the first appearance in China in December 2019. The virus has proven to be highly infectious, affecting more than 6 million cases worldwide. COVID 19 patients might develop hypoxemic respiratory failure. Although the true incidence of hypoxemic respiratory failure in patients with COVID-19 is not clear, it appears that about 14% will develop severe disease requiring oxygen therapy, and 5% will require ICU admission and mechanical ventilation. Among ICU COVID 19 patients 67% will develop Acute Respiratory Distress Syndrome (ARDS) and 56% will need invasive mechanical ventilation. A recent systematic review and meta-analysis of 9 RCTs (2,129 patients) showed that prone ventilation for at least 12 hours in patients with moderate to severe ARDS (PaO_2/FiO_2< 150mmHg) reduced mortality. Prone ventilation is ventilation that is delivered with the patient lying in the prone position and should be considered for patients who meet the operational definition for ARDS whom PaO_2 is inadequate despite optimal lung protective mechanical ventilator settings (PaO_2/FiO_2< 150mmHg, with an FiO_2 of at least 0.6, a positive end-expiratory pressure of at least 5 cm of water, and a tidal volume close to 6 ml per kilogram of predicted body weight). In COVID 19 patients with moderate-to-severe ARDS who are on mechanical ventilation, it is suggested to use prone ventilation at least 16 hours per session for 3 or 4 sessions or even more.

1.2. Aim & Scope

1.2.1. The aim of this guidelines is to provide Health Care Workers (HCWs) with a well-organized approach to optimize prone position use in patient with hypoxemic respiratory failure. The guideline was developed by doing a literature review by 4 contributors and coming up with the written document. Meetings were held with 20 ICU consultants and 20 Respiratory therapists and critical care nurses where protocol is reviewed for final version. Conflicts were solved by discussion and voting.

1.3. Purpose

1.3.1. Minimize ventilator induced lung injuries in COVID 19 patients on mechanical ventilation.

1.3.2. To Improve Clinical outcomes for patients on High Flow Oxygen Therapy due to Oxygenation failure and reduce the need of Mechanical Ventilation.

1.4. Target Population

All adult COVID 19 patients who require **adjunctive therapy to improve oxygenation either in ventilated or non-ventilated patients.**

1.5. Targeted End user

1.5.1. Adult Critical Care Medicine physicians.
1.5.2. Respiratory Specialists
1.5.3. Adult Critical Care Medicine nurses.

2. Good practice recommendations:

A checklist is designed to have a multidisciplinary discussion to ensure appropriate timing, indication, and excluding contraindication. The critical issues of the procedure details are included; regarding the preparedness of the staff, equipment, watching stability, patient safety, and when to discontinue proning. Monitoring before, during, and after proning is in the focus of the checklist and should be filled in Appendix 1.

2.1. Indication of prone positioning

2.1.1. Hypoxic stable non ventilated patient
2.1.2. Mechanically ventilated patient with moderate to severe ARDS (P/F ratio < 150 mmHg)
2.1.3. Refractory hypoxemia. Unable to reduce FiO2 to a safe level (<60%) despite optimal lung protective mechanical ventilator settings and the use of neuromuscular blocking drugs if there is evidence of ventilator dyssynchrony.

2.2. Contraindications

2.2.1 Absolute:

- Spinal instability.
- Hemodynamic instability.
- Head injury/Raised intracranial Pressure.
- Open chest Post-cardiac surgery/trauma.
- Anterior burns, chest tubes, and open wounds.
- < 24 hours post cardiac surgery.
- Central cannulation for VA ECMO or BiVAD support.

2.2.2 Relative:

- Multiple Trauma e.g. Pelvic or Chest fractures, Pelvic fixation device.
- Severe facial fractures.

- Frequent seizures.
- Raised intraocular pressure.
- Recent tracheostomy <24hrs.
- Previously poor tolerance of prone position.
- Morbid obesity.
- Pregnancy 2nd/3rd trimester.

2.3. Application and Setting of Prone Ventilation:

2.3.1. Pre-Procedure

- Multidisciplinary discussion regarding the potential risks and benefits of prone ventilation.
- Ensure no contraindications (See above).
- Inform and counsel patient/relatives.
- Ensure adequate numbers of staff available to facilitate safe procedure.
- 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.

A. Airway/Breathing

- Ensure availability and functionality of resuscitation bag with external PEEP valve.
- Difficult airway trolley checked and available. Note previous laryngoscopy grade and length of the endotracheal tube (ETT) at the lips.
- Securely tape or tie the ETT, removing any anchor fast device. If tied, then ensure padding in situ between tie and skin.\
- Suction oropharynx and airway prior to procedure.
- Ensure closed circuit suctioning is available and working throughout.
- Patient should be pre-oxygenated with 100% O2 and ensure appropriate ventilator settings. Note tidal volume and inspiratory pressure.
- Ensure a pre-proning arterial blood gas is taken (2hours prior to proning) and document results.
- Minimize ventilator disconnection as possible to avoid lung de-recruitment.

B. Cardiovascular / Lines

- Ensure all lines are sutured and secured.
- Discontinue non-essential infusions.
- Patient should be cardiovascular stable. Prepare for post-proning instability with preparation of vasopressors/inotropes.

C. Neuro:

- Patient should be receiving adequate sedation and analgesia. Deep sedation is usual (RASS score of -5)
- Consider muscle relaxation (Bolus dose may be required).

D. Skin/Eyes:

- Nursing staff to document skin integrity.
- Eyes cleaned, lubricated and taped to prevent drying and ulceration. Ideally eyes should be protected with gel pad or similar.

E. Tubes/Lines.

- Nasogastric feed should be stopped, and the nasogastric tube aspirated (ideally at least 1hr before proning). Feeding in the prone position can be resumed after 2 hours at 20 ml per hour with the patient being in reverse Trendelenburg position. Regular metoclopramide is usually given if no contraindication.
- Document Nasogastric tube length.
- Chest drains need to be well secured and placed below the patient. Tubing should run down the patient and be managed by a separate team member. Clamp only if safe to do so.
- Adequate length on the remaining lines/cables running up the patient if above the waist, or down the patient if below
- Urinary catheter should be taped to the inside of the leg.
- Secure the dialysis line.
- Secure the peripheral lines if applicable.

F. General

- Daily hygiene addressed as, mouth care, washing, dressing, changing of stoma bags.
- Ventilator as close to the patient as possible on the appropriate side.

G. Equipment list

- 3-4 pillows
- A minimum of 5 staff including one Intensivist.
- Any additional supplies, sheets or padding should be immediately available prior to the turn.
- Gel mat or doughnut ring to relieve facial pressure.

2.3.2. The turning processes:

- The Intensivist /or Respiratory Specialist controls the head and airway and directs the turn with two to three additional staff members on either side of

the patient (Fig 1).

- The Intensivist/or Respiratory Specialist issues the command to turn throughout the procedure.
- The Intensivist oversees the whole process and ensures safety.
- Pre-oxygenate the patient with FiO2 1.0 prior to turning.
- Ensure all essential lines/catheters above the waist are safely secured and directed towards the patients' head.
- Chest drains and urinary catheters are directed towards the patients' feet.
- Ensure that the patients' arms are positioned close to their sides with the palms facing inwards.
- 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.
- 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.
- 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 (Fig 2).
- 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 (Fig 3).
- At the lateral position, ensure lines, catheters and tubes are free of tension.
- Pillows should be then placed across the bed adjacent to the patient's chest and pelvis.
- The patient is then lowered carefully towards the ventilator onto the supporting pillows and into the prone position (Fig 4).
- Finally, 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.
- 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 (Fig 5).
- 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 (Fig 6). 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.
- 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.
- The patient should be nursed at 30° in the reverse Trendelenburg position.

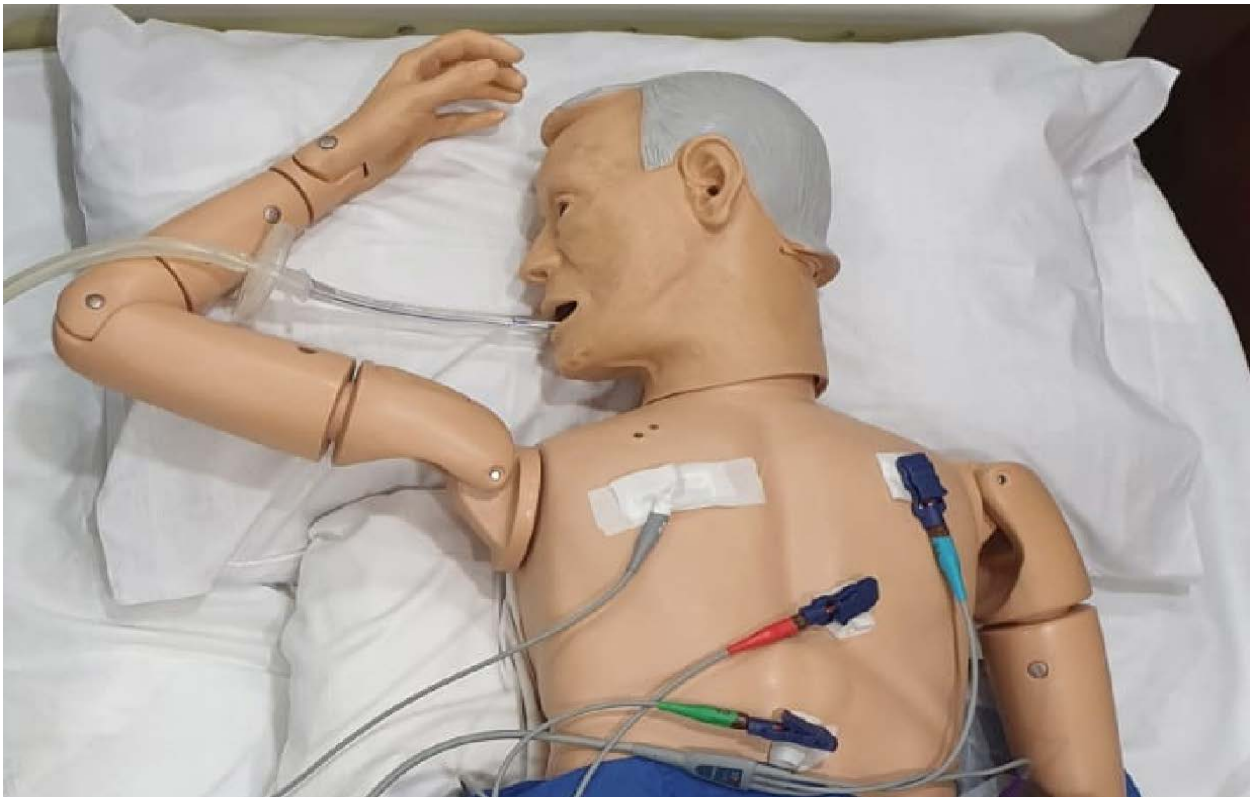
(Fig. 1) shows intensivist /or respiratory specialist and staff members on either side of the patient.

(Fig. 2) shows the patient glided away from the ventilator.

(Fig. 3) shows patient maneuvered into lateral position facing ventilator.

(Fig. 4) shows patient lowered prone toward the ventilator on the pillows.

(Fig. 5) shows prone position with head toward the ventilator.



(Fig. 6) Arms are placed in a 'swim' position.

2.3.3 Once the patient is prone (Monitoring).

- Continuously monitor SpO2 and for signs of worsening respiratory or hemodynamic status.
- Check ETT cuff pressure.
- Reattach the ECG electrodes and ensure all monitoring is re-established.
- Ensure the ETT is not kinked and that a CO2 trace is still present on the capnography. Note the length of the ETT and review ventilator settings.
- Perform complete patient ventilator assessment check.
- Take arterial blood gas (ABG) after 20 minutes and compare with pre-proning ABG.
- Reassess the position and function of all lines and tubes.
- Reposition and recalibrate all pressure transducers.
- Reassess the need for sedation/analgesia.
- 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.

2.3.4 Documentation:

Document patient's response to therapy, ability to tolerate the turn length of time in the prone position and any complications noted during or after the procedure.

2.3.5 Points to remember

- in case of cardiac arrest, start CPR in prone position. Turning is done when the team is assembled to perform supine positioning.
- Ensure the abdomen is not compressed: a hand should be able to pass under the abdomen freely.
- Patients may require increased sedation/muscle relaxants to tolerate prone positioning. Perform hourly pupil checks.
- Avoid extension, flexion or lateral rotation /flexion of the spine. All joints should be in a neutral anatomical position.
- The Intensivist should assist with repositions the patient's head on a two hourly basis while in the prone position to prevent facial skin breakdown. While one individual lifts the patient's head, the second individual moves.
- 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.

2.3.6 Returning to the supine position

Repeat the steps as outlined above:

- An Intensivist or Respiratory Specialist control the head and airway and directs the turn with two to three additional staff members on either side of the patient.
- Pre-oxygenate the patient with Fi02 1.0 prior to turning.
- Ensuring all essential lines are safely secured and directed towards the patients' head or feet.
- Ensure that the patients' arms are positioned close to their sides with the palms facing inwards.
- The bottom sheet is pulled straight and taut and a new top sheet laid across the patient ensuring that all corners are matching.
- 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.
- 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.
- 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.
- At the lateral position, ensure lines, catheters and tubes are free of tension.
- Pillows adjacent to the patient's chest and pelvis are then removed.
- The patient is then lowered carefully towards the ventilator and back into the supine position.

2.3.7 Indications for discontinuation of proning include:

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

2.4 Complications of Prone Ventilation

- Pressure sores.
- ETT dislodgement.
- Vascular line
- Facial edema.
- Transient hemodynamic instability.
- Corneal abrasions.
- Brachial plexus injury.
- Hemodialysis vascular access flow issues.

2.5 Self proning protocol

A. Self proning Benefits

Prolonged hypoxemia can lead to poor outcomes in patients with respiratory compromise. Awake proning has been demonstrated to decrease intubation and improve outcomes in ARDS patients. It is suggested for patients who presented with hypoxemia despite supplemental oxygen and who were capable of self-proning during the early stages of the COVID-19.

The intubate as an early approach was adopted in the first wave of critically ill COVID-19 patients, but early outcomes data demonstrated high mortality for intubated patients, and the inevitability of resource scarcity, if early intubation was continued, caused clinicians to seek strategies to delay or prevent the initiation of mechanical ventilation in COVID-19 patients.

The use of rotating or proning is a valuable tool in improving oxygenation and decreasing respiratory effort in many patients with moderate or severe COVID-19. Proning is simple (many patients can rotate or prone themselves, without assistance, is without cost, and utilizes no additional personnel or departmental resources.

B. Self proning technique:

Communicate with the patient explaining the benefits of the pronation therapy.
Self proning include 30–120 minutes in prone position, followed by 30–120 minutes in left lateral decubitus, right lateral decubitus, and upright sitting position.

Positioning is guided by patient wishes–salutary effects are generally noticed within 5–10 minutes in a new position; do not maintain a position that does not improve the patient's breathing and comfort.

3. Acknowledgment

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5. Appendix:

5.1 Safe prone positioning checklist

Date ……Time……..
Indication:……

Time to discontinue proning (planned/actual) …….

Patient Name: _____
MRN: _____
DOB:____ / ___ /_____

Pre-Procedure.
☐ Multidisciplinary discussion regarding the potential risks and benefits of prone ventilation.
☐ Adequate equipment: 3-4 pillows, Gel Mat.
☐ Inform and counsel patient/relatives.
☐ Ensure adequate numbers of staff available to facilitate safe procedure (at least 5).
☐ Consider any investigations, procedures and necessary transfers that would prove to be difficult to perform once the patient is prone.
Check for Contraindication (all should be checked)
☐ No Spinal instability
☐ No Hemodynamic instability.
☐ No Head injury/Raised intracranial Pressure.
☐ No Open chest Post-cardiac surgery/trauma.
☐ No Anterior burns, chest tubes, and open wounds.
☐ Not < 24 hours post cardiac surgery.
☐ No Central cannulation for VA ECMO or BiVAD support.
Airway/Breathing
☐ Difficult airway trolley checked and available.
☐ Suction oropharynx and airway prior to procedure.
☐ Pre-oxygenated with 100% O2 and ensure appropriate ventilator settings.
☐ Ensure closed circuit suctioning is available
☐ Perform pre-proning arterial blood gas and document results.
Cardiovascular Lines
☐ All lines are sutured and secured.
☐ Non- essential infusions discontinued
☐ Patient is hemodynamically stable.
☐ Prepare for post-proning instability with preparation of vasopressors/inotropes.
Neuro:
☐ Adequate sedated (RASS -5).
☐ Consider muscle relaxation (Bolus dose may be required).
Skin/Eyes:
☐ Eyes cleaned, lubricated and taped

Tubes/Lines.
☐ Nasogastric feed is stopped, and the nasogastric tube aspirated (ideally at least 1hr before proning), document length.
☐ Chest drains is well secured and placed below the patient.
After positioning
☐ Recheck hemodynamic and oxygen saturation
☐ ECG electrodes re-attached/ all monitoring is re-established.
☐ Recheck ETT cuff pressure
☐ Ensure the ETT is not kinked and that a CO2 trace is still present on the capnography.
☐ Note the length of the ETT and review ventilator settings.
☐ Take arterial blood gas (ABG) after 20 minutes and compare with pre-proning ABG.
☐ Reassess position and function of all lines and tubes.
☐ Reposition and recalibrate all pressure transducers.
☐ Reassess the need for sedation/analgesia.
☐ Assess patient's tolerance to the turning (respiratory rate and effort, heart rate or blood pressure return to normal within 5 minutes.)
☐ No extension, flexion or lateral rotation /flexion of the spine.
☐ All joints should be in a neutral anatomical position.
☐ Patient's head is repositioned on a two hourly basis
Discontinuation of proning if:
☐ Duration of prone position (for safety reasons, from 12 to 16 H).
☐ The patient becomes hemodynamically unstable.
☐ The patient has a worsening respiratory status.

Bedside Nurse: **Signature:**

Date:

ICU Physician name: **Signature:**

Date