Prone Positioning of the Intubated Patient

Reference #:

Site	Service/Department/Unit	Disciplines
Fiona Stanley Hospital Fremantle Hospital	Intensive Care Unit	Medical Nursing Allied Health

1. Introduction

Acute Respiratory Distress Syndrome (ARDS) is an acute diffuse inflammatory lung injury that results in refractory hypoxaemia, reduced respiratory compliance and a ventilation-perfusion mismatch (1). Prone positioning is a treatment modality for ARDS (2).

Prone positioning allows for blood to flow to the healthy areas of the lung resulting in improved oxygenation by improving the ventilation/ perfusion (V/Q) relationship (2, 3). Use of the prone position along with the application of positive end-expiratory pressure (PEEP) allows for alveolar recruitment, increased functional residual capacity (FRC) and a reduction in atelectasis (2). The prone position also improves respiratory mechanics with a more homogenous distribution of ventilation. In turn this protects against over-distension of open lung units and thus ventilator induced lung injury.

While there is no consensus in the literature defining optimal length of time a patient should be positioned prone, evidence suggests that prone ventilation for 12 to 16 hours is associated with improved survival (2, 4, 5).

This policy outlines the indications and contraindications for prone positioning. It provides procedural guidelines for applying the prone position in mechanically ventilated patients.

The decision to position a patient prone must be made by an ICU consultant.

A senior medical officer (MO) with advanced airway and intubation skills must be present throughout the turn, and present in the ICU at all times whilst a patient is in the prone position.

2. Terminology

Prone Position	The process whereby a patient is positioned face down on their stomach in order to facilitate improved gas exchange.
Acute Respiratory Distress Syndrome (ARDS)	A type of respiratory failure characterized by the presence of widespread inflammation of the lungs resulting in diffuse infiltrates, decreased lung compliance and a ventilation/perfusion mismatch causing profound hypoxaemia.
Advanced airway skills	This includes but not limited to laryngoscopy and the placement of an endotracheal tube and knowledge of a difficult airway algorithm.
Trained in prone positioning	This means experienced in or having successfully completed prone positioning simulation and training.

The complications associated with prone positioning related to the turn itself can generally be avoided with adequate training and planning by ensuring the presence of a minimum of five staff comprising of:

- a Medical Officer with advanced airway skills
- two nursing staff, of which at least one has the skills, knowledge and experience in the procedure,
- two other staff members (as a minimum), i.e. MO, physio, nurse or AIN - they do not require specific training and act at the direction of the trained clinicians.

3. Indications and contraindications for Prone Positioning

Prone positioning should be considered for patients with refractory severe ARDS (PaO_2/FiO_2 ratio < 150 mmHg with an FiO_2 > 0.6 and a PEEP >10cm H_2O) (2, 4, 5).

3.1 Absolute contraindications to prone positioning (4, 6–10)

3.1.1. **Airway**

- Tracheal or maxillo-facial surgery within 2 weeks
- Tracheostomy

3.1.2. **Circulation**

- Recent (<48 hours) cardiac arrest or unstable arrhythmias

- Acute bleeding (e.g. haemorrhagic shock, massive haemoptysis)
- Large vessel mobile deep vein thrombosis
- Cardiothoracic surgery within 2 weeks, unstable mediastinum, or open chest wound
- Presence of a ventricular assist device
- Presence of an intra-aortic balloon pump

3.1.3. Clinical conditions

- Single anterior chest tube with air leaks
- Increased intraocular pressure
- Raised intracranial pressure >20mmHg or cerebral perfusion pressure <60mmHg
- Refractory seizures
- Spinal instability or patients at risk of spinal instability
- Unstable fractures of femur, pelvis, face or need for traction
- Abdominal surgery in last 2 days
- Open abdomen
- Anterior burns

3.1.4. Logistical issues

- Lack of availability of staff with required knowledge, skills and experience

3.2 Relative contraindications to prone positioning (4, 6–10)

- Mild to moderate ARDS (PaO_2/FiO_2 ratio > 150 mmHg)
- ARDS duration > 48 hours before initiation of prone ventilation
- Difficult airway
- Morbid obesity and/or difficult body habitus
- Shock (persistent mean arterial pressure <65mmHg and/or noradrenaline requirement >0.5ug/kg/min or equivalent)
- Recent deep vein thrombosis treated for <2 days
- Major abdominal surgery
- Severe burns
- Lung transplant recipient
- Clinical conditions limiting life expectancy (e.g. oxygen or ventilator-dependent respiratory failure)
- Recent pacemaker insertion or temporary transvenous pacing wire
- Pregnancy-see section 4.1

3.3 Complications of prone positioning in order of occurrence (4, 6–11)

- Endotracheal tube obstruction, extubation, endobronchial migration
- Pressure injury, mainly ocular, forehead and anterior chest
- Enteral feeding intolerance and gastric aspirations
- Dislodging of invasive devices
- Venous stasis and facial oedema
- Retinal damage due to direct pressure
- Neuropraxia, nerve damage
- Shoulder dislocation/soft tissue damage

4. Conditions requiring special considerations

4.1. Pregnancy

In general, prone positioning should not be withheld in pregnant patients as prone positioning can improve gas exchange, hemodynamics and patient outcome, all being in the interest of the fetus. Obstetrician advice is recommended based on individual clinical condition of the patient

From about 20 weeks onward, the fundus of the uterus is approximately at the umbilicus and fetal compression can occur, therefore prone position is relatively contra-indicated. In addition, left lateral tilt is recommended to reduce the risk of aorto-caval compression.

From 24 weeks pregnancy, delivery of the fetus should be considered as this might be in the best interest of the mother. Cardio-tocography (CTG) is generally not required before 24 weeks.

4.2. Intra-abdominal hypertension

Prone position may increase intra-abdominal pressures (IAP). However, intra-abdominal hypertension is not a contra-indication to prone positioning as prone positioning may reduce IAP provided cushions are appropriately used to suspend the abdomen (12). In patients at risk of intra-abdominal hypertension, we recommend measuring IAP before and after prone positioning to ensure IAP does not increase.

5. Mechanical ventilation whilst in prone position

5.1. Mode of ventilation during prone position

No mode of ventilation has been shown to be superior in patients with ARDS ventilated in prone position (4). The mode of ventilation to be used is at the discretion of the senior medical officer.

Most studies have used traditional ARDS protective ventilation settings (tidal volume of 6 mL/kg predicted body weight and plateau airway ≤ 30 cmH_2O) (4). As the respiratory system compliance can improve during prone position, tidal volumes can increase and require close monitoring. Assist control ventilation is ideal during prone ventilation providing a set tidal volume. If using assist control ventilation, appropriate alarms for the respiratory rate need to be set to avoid inappropriate hyper–ventilation.

5.2. Prone versus Airway Pressure Release Ventilation (APRV)

Independently, mechanical ventilation in prone position and non-prone APRV have been shown to improve outcome in patients with acute respiratory failure, although

the body of evidence is more robust for ventilation in prone position (13, 14). There are no studies using APRV in the prone position therefore we don't recommend using APRV ventilation while in prone position.

6. Procedure for prone positioning a ventilated patient (6–10)

6.1. Resources

- Ensure intubation trolley is available
- Turning team of minimum 5 members of staff, including:
    - 1x Senior MO with advanced airway skills and trained in prone positioning
    - 2x nurses, of which at least one has the skills, knowledge and experience in prone positioning
    - 2x other staff members (MO, physio, nurse or AIN).
    - If possible a further staff member can be utilised to manage invasive lines and act as a runner.
    - Ensure adequate staffing to reposition back to supine when required.
- 3-4 pillows (firm) and clean linen (if required)
- 2 slide sheets
- Pressure injury prevention devices e.g. mepilex heel and sacral dressings, gel pads, head foam.
- Soft tape to tape eyes.
- Set of ECG dots for repositioning ECG leads.

6.2. Preparation

- Whenever possible, explain the manoeuvre and potential risks to the patient and/or their significant others.
- Ideally patient remains in the prone position for between 12 and 16 hours.
- Consider performing a CXR to exclude baraotrauma prior to prone position.
- Assess body habitus. Consider exactly how the patient's head, neck, and shoulder girdle will be supported after they are turned prone.
- Ensure airway is secure prior to turning the patient
    - document level of endotracheal tube (ETT),
    - check pressure in ETT cuff,
    - change securing device if required
- Ensure inline suction is in situ and functioning.
- Ensure invasive lines and drains are well secured, labelled and functioning. Change dressing(s) if required.
- Disconnect any unused/ unnecessary lines and devices.

- Administer eye care to avoid corneal abrasions. Use a non-adherent dressing or tape to ensure eyes are closed.
- Stop enteral feeds. Aspirate (and discard any contents) and spigot the nasogastric tube to reduce the risk of emesis/ aspiration during turn.
- Suction the oropharynx and provide mouth care. Brush teeth/ gums if appropriate.
- Administer prescribed sedation and/ or muscle relaxant if required.
- If clinical condition permits, nurse on a pressure relieving mattress.
- Assess and document patient's skin condition, integrity and pressure areas using the skin integrity bundle. Consider the use of pressure relieving adjuncts where required e.g. gel pads, mepilex dressings.
- Perform and record baseline observations. Ensure a working oxygen saturation probe is attached at all times.
- Pre-oxygenate the patient with 100% FiO_2 for 1-2 minutes prior to beginning the procedure in order to reduce the potential for hypoxic changes/desaturation.
- Have slide sheet and pillows ready. Depending on the patient's body habitus a variety of different pillows may be required. Use a pillow that will provide a dense support surface for the patient. Two pillows in one pillow slip, a rolled pillow or a single pillow may be used to provide adequate support. This allows the pillows to provide more support especially of the abdominal area.

6.3. Turning procedure

- A senior MO must take responsibility for the airway and any invasive lines at the patient's head. This MO must be trained in advanced airway skills and prone positioning technique.
- Two people are positioned either side of the patient. If available a sixth person may be utilised to manage invasive lines and drains (see Figure 1).

Figure 1: Placement of team; a MO responsible for airway at the head of the bed with two staff either side of the patient and an additional staff member to manage invasive lines if available (not shown).

- Position folded slide sheet under the patient with the open edge to the side the patient will turn away from. Use the slide sheet to slide the patient to the far side of the bed. Place fresh linen at this point if linen change is required.

Figure 2: Using slide sheets to move the patient to the far side of the bed.

- Place the patient's hand that is closest to the middle of the bed under the hip in neutral position (palm facing towards hips).

Figure 3: Positioning of the patient's hand during turning into prone. Note that the hand should be supported during the turn to prevent it from sliding through and causing injury to the patient.

- The leg closest to the edge of the bed is bent and crossed over the opposite ankle (see Figure 2).
- When the team is ready, the person in charge of the airway instructs the team to turn the patient to a 90-degree position.

Figure 4: Turning patient to 90 degrees.

- Throughout the turn, the MO is in complete control of the airway.

Figure 5: Complete control of the airway throughout the turn.

- While in the 90 degree position monitoring leads should be repositioned posteriorly to ensure continuous cardiac monitoring throughout the procedure.

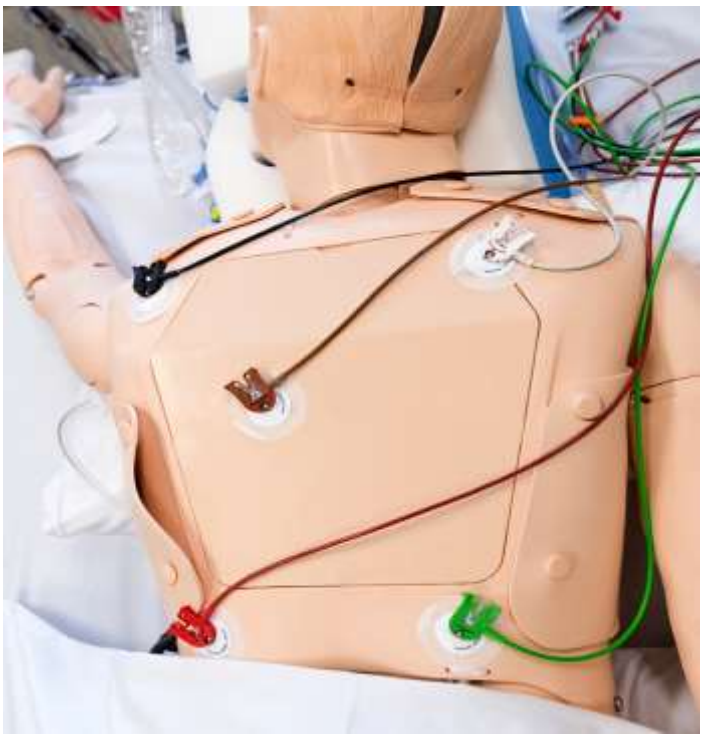

Figure 6: Placement of ECG leads posteriorly with the “precordial” lead at the lower end of the left scapula (7). In the 90 degree position, if the patient is not close enough to the back side of the bed use slide sheets to move the patient so they will be central at completion of turn. During this repositioning ensure the central hand (as per figure 3) is supported by a member of the turning team to remain in a neutral position so the shoulder and nerve plexus is not injured.

- Place pre-prepared pillows to support the chest and pelvis on the bed. Depending on the patient’s body habitus a variety of different pillows may be required. Use a pillow that will provide a dense support surface for the patient. Two pillows in one pillow slip, a rolled pillow or a single pillow may be used to provide adequate support. The pillows should be at the level of pectoralis and lower abdomen (avoiding femoral or abdominal compression).
- At the direction of the MO managing the airway, the team turns the patient into the prone position, gently lowering them onto the pillows. Slide sheets which will still be under the pillows can be used to centralise the patient on the bed. Remove the slide sheets once the patient is in a suitable position.
- A pillow can also be placed under the shins to protect the knee and ankle joints and offload toes to prevent pressure injury.

Figure 7: Patient in the prone position

- To complete the turn ensure the head is placed in a safe and comfortable position. The head should be in a neutral position and the neck should not be hyper-extended or excessively rotated. Depending on the patient's body habitus, this position may be achieved with a folded sheet, thin pillow or head foam as shown in figure 8. Whichever device is used, ensure the pressure points of the face are not compressed.
- The MO will ensure the ETT is not kinked and has not migrated during the turning process. Suction the airway if needed.

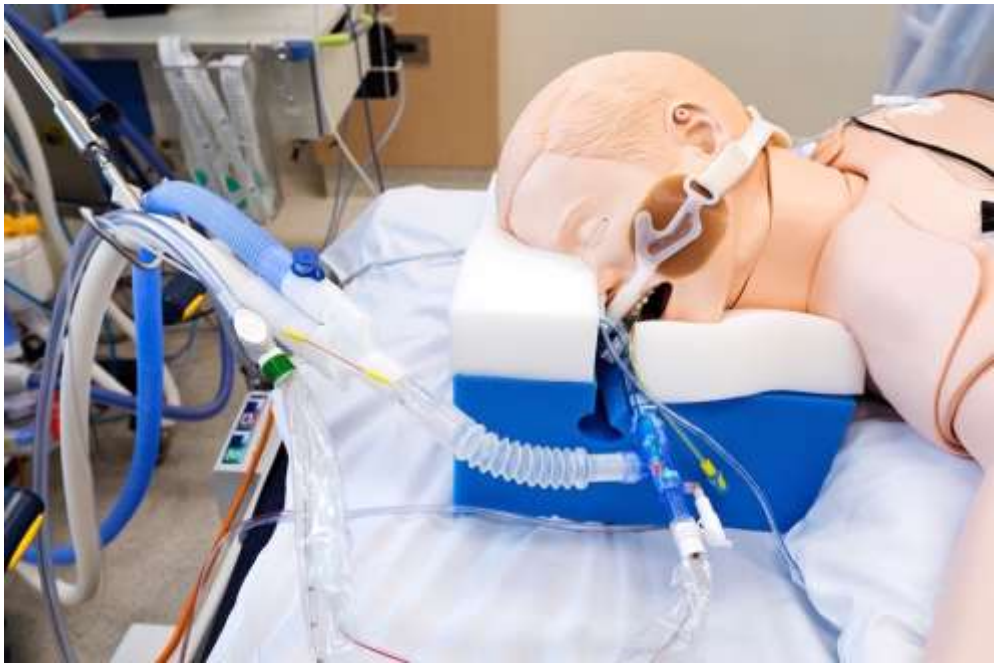

Figure 8: Checking the airway immediately post turning prone.

6.4. Immediate care after turning into the prone position

- Complete a full patient assessment using the airway, breathing, circulation, disability and exposure (ABCDE) approach and document findings. Refer to the Management of the Critically Ill Patient in the Intensive Care Unit policy
- Confirm ETT position and assess the condition of the securing device to ensure the ETT is adequately secured.
- Recheck cuff pressure.
- Suction ETT to remove any secretions that may have been loosened by repositioning.
- Ensure eye balls are free and not compressed (to be confirmed by medical officer) and document in metavision.
- Ensure that the abdomen is not touching the hard surface of the bed. A hand should be able to pass freely under the abdomen. All joints should be in a neutral anatomical position.
- Confirm nasogastric tube position and recommence nasogastric feeding. Refer to FSH Enteral Tubes and Feeding Administration and Management NPS.
- Resume other infusions and other therapies that were ceased for the turning procedure, as directed by MO.

6.5 Swimmers position

- The ideal body position during prone is the “swimmers position”. This limits the risk of facial pressure injuries often seen as result of the prone position. It also relieves the adverse neural tension on the brachial plexus by the regular movement of the upper limb position. To achieve the swimmers position place one arm up and one arm along the side of the body, with the head turned towards the upper arm. Change the side of the swimmers position every 2 hours.
- A MO with advanced airway skills will be required to manage the airway during these side changes.
- Carefully rotate the arms at the shoulders, by bringing the arms to a neutral position with elbows flexed (hands hanging low to the floor mid turn).
- Be careful not to hyper-extend the arms at the shoulders; this may lead to overstretch and injury to the brachial plexus.
- The head is to be turned to face the hand which is now up.
- Small adjustments to limbs may be required to reduce the risk of pressure injuries.
- Ensure the lower legs are supported or elevated to avoid prolonged plantarflexion of the ankles.
- An alternative position to the “swimmers position” is to raise both arms above the patient’s head with both elbows slightly bent.
- Unless contraindicated, tilt the bed into reverse Trendelenburg position to reduce the risk of facial and peri-orbital oedema and of respiratory aspiration.

- Mild intermittent lateral repositioning (20° to 30°), changing sides every 2-3 hours in addition to the above position may further help reduce the risk of pressure injuries .
- Refer to the physiotherapy team to provide movement of extremities on a regular basis.
- Ensure changes in position are documented in the Clinical Information System.

Figure 9: Swimmers position.

7. Ongoing care of a patient in the prone position

- Ideally a patient will remain in the prone position for between 12 and 16 hours and all usual care must be provided while the patient is in this position. A gradual improvement in gas exchange can be seen within 1 to 18 hours of positioning a patient prone. If the patient exhibits intolerance to prone positioning (e.g. deterioration in oxygenation or cardiovascular instability) they should be returned to supine straight away. However, improved survival is not dependent on improvement in gas exchange.

- Perform all routine care as per the Management of the Critically Ill Patient in the Intensive Care Unit policy, and the Care of the Intubated Patient in the Intensive Care Unit policy

In event of cardiac arrest, the patient should be immediately returned to the supine position.

However if indicated, defibrillation can be conducted posteriorly to prevent delay - one pad is to be placed low down on the left anterior side and one over the left scapula (15) as per the image below.

Figure 10: Positioning defibrillation pads on patient in the prone position with one down on the left anterior side and one over the left scapula.

- Administer sedation and analgesia as prescribed to maintain tube tolerance. Monitor effect using Richmond Agitation and Sedation Score (RASS) and Behavioural Pain Score (BPS).
- Assess areas susceptible to pressure every 2 hours to minimise the risk of pressure injury development. Take particular note of the breasts, male genitalia, knees, shins, toes, ears, forehead and the chin. Use preventative devices such as gel pads and mepilex® dressings as appropriate. Perform Braden score and inspect skin each shift and document in the skin integrity bundle.
- Check and ensure eyes are free and not compressed every hour and document in the Clinical Information System.

- Perform regular eye and mouth care. Suction oral secretions regularly to prevent skin breakdown and ocular infection.
- Perform all nursing procedures such as washes, oral care, skin assessment, ETT re- taping, central venous catheter (CVC) dressing changes, chest X-ray (CXR) etc. while the patient is supine.

8. Repositioning to supine position

8.1. Resources

- Ensure intubation trolley is available
- Turning team of 5 members of staff, including:
    - 1x experienced MO with advanced airway skills and is trained in prone positioning
    - 2x nurses, of which at least one has the skills, knowledge and experience in prone positioning
    - 2x other staff members (MO, physio, nurse, AIN)
- Slide sheets and clean linen (if required)

8.2. Preparation

- Whenever possible, explain the manoeuvre to the patient and/or their significant others.
- Ensure airway is secure prior to turning the patient to help prevent accidental dislodgement.
- Document level of ETT.
- Ensure inline suction is in situ and functioning.
- Ensure invasive lines are well secured, labelled and functioning, to prevent dislodgement of lines.
- Perform oropharyngeal suctioning.
- Administer prescribed sedation and/or muscle relaxant if required
- Pre-oxygenate the patient with 100% FiO_2 for 1-2 minutes prior to the turn to reduce the potential for hypoxic changes/desaturation.
- Perform and record baseline observations.

8.3 Turning Procedure

- A senior MO must take responsibility for the airway and any invasive lines at the patient's head. This MO must be trained in advanced airway skills and prone positioning technique. Two people are positioned either side of the patient. If available, a sixth person may be utilised to manage invasive lines and drains (see Figure 1).
- Position folded slide sheet under the patient. Use the slide sheet to slide the patient to the far side of the bed. Place fresh linen at this point if linen change is required

- The patient's hand that is closest to the middle of the bed is placed under the hip and the leg closest to the edge of the bed is crossed over the opposite ankle.
- When the team is ready and on the count of 3, the person in charge of the airway instructs the team to turn the patient to a 90 degree angle.
- Reposition ECG electrodes anteriorly.
- Rearrange monitoring cables, the indwelling catheter and any invasive monitoring devices and drains to ensure continuous monitoring and avoid tangled lines/dislodgement. Lower the patient onto their back.
- Complete a full patient assessment using the airway, breathing, circulation, disability and exposure (ABCDE) approach and document findings. Refer to the Management of the Critically Ill Patient in the Intensive Care Unit and Care of the Intubated Patient in the Intensive Care Unit policy.

9. Compliance/Performance Monitoring

Compliance against this procedure will be evaluated and monitored on a case by case basis using clinical review incident processes.

10. Related Policy Documents

Management of the Critically Ill Patient

FSH Care of the Intubated Patient Policy

FSH Intensive Care Unit Enteral Feeding Guideline

11. Related Standards

NSQHS 1: Governance for Safety and Quality in Health Service Organisations

NSQHS 8: Preventing and Managing Pressure Injuries

NSQHS 9: Recognising and Responding to Clinical Deterioration in Acute Health Care

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13. Authorisation

EXECUTIVE SPONSOR:					
Version	**Date Issued**	**Compiled/Revised By**	**Committee/Consumer Group Consulted**	**Endorsed By**	**Revision due**

1	mm/20yy	Job Title	Committee	Policy or Executive Committee	mm/20yy
2					