

Clinical Guideline for Prone Positioning patients with Hypoxaemic Respiratory Failure in Critical Care

Key Points

- The pathophysiology of prone positioning
- Tools for selecting patients for prone positioning
- A step-wise guide for turning a ventilated patient prone
- Nursing care considerations for the patient once prone
- Cardiac arrest in the prone position

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This guideline has been registered with the trust. However, clinical guidelines are guidelines only. The interpretation and application of clinical guidelines will remain the responsibility of the individual clinician. If in doubt contact a senior colleague or expert. Caution is advised when using guidelines after the review date. This guideline is for use in Frimley Health Trust hospitals only. Any use outside this location will not be supported by the Trust and will be at the risk of the individual using it.

Please continue to use this guideline but be aware that it is in review (16/12/2024).

Version Control Sheet

Version	Date	Guideline Lead(s)	Status	Comment
1.0	2016	Marie-Clare Ratcliffe	Sister	
2.0	2019	Marie-Clare Ratcliffe	Sister	

Related Documents

Document Type	Document Name
Clinical Document	Proning Checklist
ICS	Guidelines for the Provisions of Intensive Care Services (GPICS)

Abbreviations

ALI	Acute Lung Injury
ARDS	Acute Respiratory Distress Syndrome
CT	Computed Tomography
PEEP	Positive End Expiratory Pressure
PP	Prone Positioning
VILI	Ventilator Induced Lung Injury
CPR	Cardiopulmonary Resuscitation
IAP	Intra-Abdominal Pressure

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1.0 PATHOPHYSIOLOGY AND RATIONALE OF PRONE POSITIONING

1.1 WHAT IS PRONE POSITIONING?

PP involves turning the patient face down and continuing to deliver mechanical ventilation. It has been used in ICU's for over 40 years after demonstrating a significant initial improvement in oxygenation, now understood to be resultant from reducing intrapulmonary shunting by better ventilating well perfused areas of lung (Guérin 2017). CT imaging of a patient with ARDS demonstrates redistribution of consolidation from dorsal to ventral regions of lung, which creates a more even tidal volume distribution and reverses the pleural pressure gradient which increases in negativity (Kallet 2015). The altered gravitational effects from repositioning also reduce the compressive effects of the heart, mediastinal structures and the abdominal wall on the lungs.

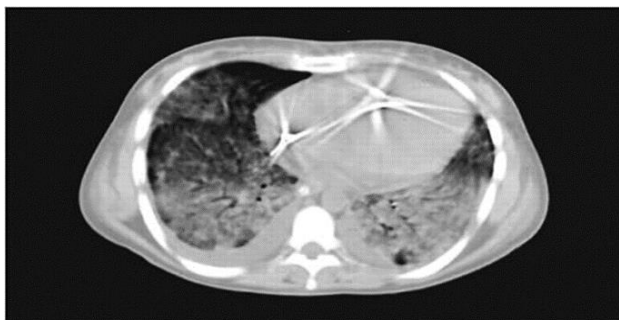


Figure 1
CT scan of ARDS patient in the supine position:
predominantly dorsal areas of consolidation.

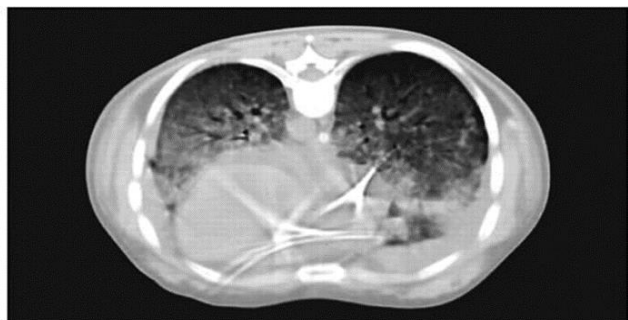


Figure 2
CT scan of ARDS patient in the prone position:
a rapid distribution of pulmonary opacities from
the dorsal to the ventral areas of the lung

1.2 WHY IS PRONE POSITIONING BENEFICIAL?

Evidence suggests that in addition to improving oxygenation, PP may also assist in reducing the iatrogenic complications associated with mechanical ventilation. Through increased recruitability, volutrauma is reduced and atelectotrauma eased with maintenance of PEEP (Brower 2004). This causes a decrease in peak airway pressures and corresponding reduction in VILI. PP may also be superior to PEEP for reducing shunt fraction in patients with ARDS, who have localised as opposed to diffuse infiltrates; has been shown to reduce PaCO₂; enhance secretion mobility and is significantly associated with lung recruitability and improved oxygenation.

1.3 WHAT EVIDENCE IS THERE?

PP has extensive pathophysiological justification and RCT and meta-analyses have strongly demonstrated a correlation between early implementation, within 48 hours of ARDS diagnosis, and survival benefit at 28 and 90 days (Guérin 2013; Sud 2014; Lee 2014).

1.4 RECOMMENDATIONS AND GUIDELINES

Recent publication recommendations have made PP a standard of care, reporting severe ARDS patients treated with lung protective ventilation and PP ≥12 hours a day had an approximate 25% decrease in the risk of death (Intensive Care Society 2018; American Thoracic Society, European Society of Intensive Care Medicine and Society of Critical Care Medicine 2017).

2.0 PATIENT SELECTION FOR PRONE POSITIONING

2.1 ARDS - THE BERLIN DEFINITION

The European Society of Intensive Care Medicine ARDS Definition Task Force (2012) identifies three grades of ARDS severity for the determination of treatment:

- Mild ($\text{PaO}_2/\text{FiO}_2$ 200-300mmHg)
 - Moderate ($\text{PaO}_2/\text{FiO}_2$ 100-200mmHg)
 - Severe ($\text{PaO}_2/\text{FiO}_2 \leq 100\text{mmHg}$)
- 
- Coupled with
 $\text{PEEP} \geq 5\text{cm H}_2\text{O}$

This categorisation is paired with the onset of symptoms being present within one week of clinical insult; bilateral opacities on chest imaging and the origin of oedema not explained by cardiac failure.

This definition was validated using retrospective cohorts demonstrating increased mortality with severity (Ferguson 2012).

2.2 THE MURRAY SCORE

The Murray Score is a standardised assessment tool used in patients with severe hypoxaemic respiratory failure for stratifying ALI severity in the setting of ARDS. When combined with other clinical factors the score assists patient selection for extracorporeal membrane oxygenation (ECMO).

It categorises the presence of:

- 1-4 quadrant consolidation on CXR
- Severity of $\text{PaO}_2/\text{FiO}_2$
- Level of PEEP (5-15cm H_2O)
- Compliance ml/cm H_2O (≤ 19 - ≥ 80)

The result compliments clinical judgment in conjunction with other clinical factors when determining further treatment options (Guy's and St. Thomas' NHS Foundation Trust 2019).

2.3 OTHER INDICATIONS FOR PRONE POSITIONING

- Patients are receiving prolonged ventilation for acute or acute on chronic respiratory failure
- Patients have evidence of basal collapse/consolidation and require postural drainage for effective secretion removal
- Are acutely hypoxaemic in the absence of ARDS

3.0 CONTRAINDICATIONS

- **Trauma** - spinal instability, external pelvic fixation, recent pelvic or chest fractures, traction, facial trauma/post oral maxillary facial surgery
- **Head injury and/or raised ICP** - patients experiencing frequent seizures. Raised intra-ocular pressure (not always considered to be an absolute contraindication)
- **Haemodynamic instability (severe)** - despite fluid resuscitation and/or inotropes, acute haemorrhage, recent cardio thoracic surgery/unstable mediastinum
- **New tracheostomy** < 24hrs
- **Pregnancy** – in the 2nd-3rd trimester

It is up to clinicians to interpret the relevance of individual patients' potential contraindications in the context of risk versus benefit. Obesity and abdominal surgery were previously identified as contraindications to PP; however recent small scale studies have demonstrated survival benefit in these patient groups when undergoing PP for an average of 6 hours a day (Gaudry 2017; Weig 2014).

4.0 RESOURCES AND PERSONNEL

- Staff participating in the procedure should have undertaken the required training and/or bedside simulations and be confident and competent in the physical process of PP a ventilated patient.
- Effective communication is crucial to the safety and success of the procedure.
- If not involved, make sure the NIC is aware.
- X6 competent personnel either side plus airway competent doctor at the head co-ordinating the procedure.

5.0 EQUIPMENT REQUIRED

- Fully working profiling bed and air mattress
- Slide sheet
- Extra pillows
- X2 sheets (x1 will already be under the patient)
- Any pressure relieving device being used

6.0 CONSIDERATIONS, RISKS AND COMPLICATIONS

- Is the procedure documented in the clinical notes?
- Paralysis should be used for the procedure, unless contraindicated
- It is acceptable to prone a patient on APRV
- If disconnecting from the ventilator consider clamping the ETT

Potential risks and complications of the procedure include:

- | | |
|--|---------------------------------|
| • ETT dislodgement and/or obstruction | • Vomiting |
| • Failure to ventilate | • Hepatic and renal dysfunction |
| • Pneumothorax | • Musculoskeletal injury |
| • Accidental removal of drains or IV lines | • Soft tissue injury |
| • Cardiac arrest, hypotension | • Limb compartment syndrome |
| • Arrhythmias | • Nerve palsies and neuropraxia |
| • Raised IAP | • Dependent oedema |
| • Mal-absorption of feed | • Ocular damage |
- (Messerole 2002).

Each decision to prone should be consultant led and patient specific limitations individually considered

7.0 CARDIAC ARREST IN THE PRONE POSITION

PUT OUT A 2222 CRASH CALL TO RAPIDLY OBTAIN ADEQUATE PERSONEL TO TURN THE PATIENT SUPINE ASAP

7.1 CARDIOPULMONARY RESUSCITATION

- CPR should be performed in the prone position while preparing to return supine. Precious time gained may translate to well-maintained brain tissue resulting in return of spontaneous circulation with a meaningful outcome. Compressions should be administered perpendicular to the patients back with the hands over the T7-10 vertebral bodies.
- CPR in the PP is more challenging as access to the airway and veins is difficult. The rushed turning of a critically ill ventilated patient from prone to supine may result in loss of airway and/or vascular lines if not performed safely with adequate staff compounding the situation (Mazer 2003; Kwon 2017).
- A second person can place their hands or firm surface directly under the patient providing counter pressure; sternal support will increase the efficiency of cardiac compressions (Wei 2006).

7.2 DEFIBRILLATION

- The patient can also be defibrillated in the prone position with the electrode pads placed in reverse position, one in left mid axillary line and the other over the right scapula. Anterior posterior placement has also been shown to be effective due to reduced impedance (Link 2010).
- Efficacy of defibrillation is improved if discharged during expiration, without positive end-expiratory pressure to further minimise transthoracic impedance, but the delivery of a shock should never be delayed to achieve this (Walsh 2002).

7.3 POSITIONING

- The patients head should be turned to the side to protect the neck and allow for ease of access to the ETT. Both arms should be placed by their sides to prevent glenohumeral joint injury.

Follow appropriate ALS algorithm

Resuscitation Council (UK) 2014

8.0 GUIDELINES FOR TURNING PATIENTS PRONE

The decision to position a patient prone should be made following discussion with a Consultant and documented in the medical notes.

8.1 STAGE 1: PREPARATION AND ASSESSMENT

<u>ACTION</u>	<u>RATIONALE</u>
Refer to page 3 for suitability	Ensure correct patient selection Standardise assessment, technique and evaluation of procedure
Inform patient and relatives of intended procedure	Avoid unnecessary anxiety
Perform arterial blood gas analysis and document prior to procedure	To aid patient selection Facilitate evaluation of procedure
Disconnect all non-essential monitoring equipment and intravenous lines Ensure remaining lines are secured and have the length and flexibility to accommodate the procedure	Reduce the risk of accidental displacement and removal of lines during the procedure Maintain patient safety
Disconnect enteral feed and aspirate nasogastric tube	Minimise risk of regurgitation and aspiration of stomach contents during procedure
Ensure that endotracheal/tracheostomy tube is adequately secure with tapes and sponges (NOT ANCHORFAST) Check and document intubation grading, size of tube and length at patient lips	Reduce risk of accidental tube displacement Prevent pressure damage Facilitate effective repositioning or re-intubation should it become necessary Monitor any displacement
Perform endo-tracheal/tracheal and oral-pharyngeal suctioning according to local policy Ensure closed circuit suctioning catheter is in situ	Remove secretions that could shift to plug-off or drain from patient on turning Protection of staff Promote patient comfort For quick ability to suction
Assess the patients' sedation score using RASS and observe for any non-verbal indications of pain Administer the necessary boluses as prescribed and according to local policies	Reduce the risk of patient discomfort, pain, and/or agitation during the procedure Ensure ventilator compliance, optimal ventilation and patient safety

Consider the use of intravenous muscle relaxant at this stage adhering to local guidelines. Assess effectiveness with nerve stimulator (Train of Four) prior to commencing procedure.

8.2 STAGE 2: TURNING THE PATIENT PRONE

The patient should ideally be rolled towards the ventilator unless you need to consider other attachments such as CVVH lines. The person responsible for the patients' head and airway should co-ordinate the procedure.

<u>ACTION</u>	<u>RATIONALE</u>
Position the doctor at the head end with other people on the sides opposite each other	Ensure airway safety Ensure equitable distribution of weight
Insert sliding sheet under the bottom bed sheet (to slide left to right) and position patients' arms close to their sides	To conform to local manual handling policy To ease turning and reduce the likelihood of limb injury
Position pillows: 1. Across chest (2 if large abdomen). Consider breast placement in women 2. Across pelvis 3. Across knees (can be placed after turning if easier)	Reduce the risk of over distension of the anterior capsule of the shoulder joint and injury to the brachial plexus (by allowing the patients' shoulders to fall slightly forwards) Enhance a negative pleural pressure, thus optimising the patients' functional residual capacity and improving basal expansion of the lungs Enhance haemodynamic stability Ensure the abdomen is free Minimise pressure exerted on the patients' knees Ensure that the ankles are not held in full plantarflexion due to risk of soft tissue and nerve injury i.e. the pillow should support the lower leg from the knee to ankle joint. Reduce the risk of shortening the Achilles tendon Reduce pressure over the head of the fibula which may predispose to injury of the common peroneal nerve
Pull bottom sheet straight and taught then place the second sheet over the top of the patient, matching all four corners	Aid safe and effective turning
Uncover the patients' head and face. All personnel on either sides of the bed then roll the long edges of both (top and	Ensure the roll is equally distributed and is as tight as possible Effectively cocoon the patient within the

bottom) sheets tightly together in opposite directions	two sheets
Once the person responsible for the airway is satisfied with the patients' safety, slide the patient across the bed AWAY from the ventilator as close to the opposite edge of the bed as possible. The patient is supported by the personnel on the opposite side of the bed to the ventilator. All personnel should maintain a firm grip on the rolled sheets throughout	Ensure clear coordination and facilitate safe and effective turning of the patient
Turn the patient to a lateral position maintaining sheet integrity and security TOWARDS the ventilator and then lower into the prone position, onto the original top sheet and arranged pillows. This should be performed slowly allowing personnel on either side of the bed to swap over supporting hands	Ensure safe handling of the patient and effective use of the sandwich technique
All personnel, on the count of the person responsible for the airway, slide the patient into a more central position on the bed	For patient safety For effective management of the patient

8.3 STAGE 3: PATIENT POSITIONING

<u>ACTION</u>	<u>RATIONALE</u>
The patient should be maintained in the swimmers position, ensure that the arms are alternated. The shoulder of the prominent arm should be positioned at 80°abduction and the elbow at 90°	Minimise the risk of over extension and development of limb contractures To avoid subluxation of the glenohumeral joint
Alternate arms and head 2 hourly	Avoid pressure sores to the head and neck Extend the wrist and allow flexion of joints Promote effective sputum drainage Maintain soft tissue length and mobility Minimise corneal oedema
Place the bed in the reverse Trendelenberg position (30-40° foot down) Full tilt bed to 30 degrees (if haemodynamically stable)	Minimise the development of facial oedema and reduce risk of gastric aspiration In accordance with VAP protocol
Maintain eye care Ensure eyes closed with gauze/tape if necessary	Minimise risk of corneal drying/abrasion/ulceration

8.4 STAGE 4: MAINTENANCE AND CARE OF THE PRONED PATIENT

<u>ACTION</u>	<u>RATIONALE</u>
Reattach all monitoring that was removed for turning Resume enteral feeding	Re-establish safe monitoring and allow continuation of therapies Prevent malnutrition
Perform oral and tracheal suctioning immediately following the procedure	Clear oral/pulmonary secretions mobilised as a result of prone positioning
Observe SaO ₂ levels Perform arterial blood gases every 20 minutes following prone positioning for 1 hour. Look for at least a 20% increase in the PaO ₂	Initial assessment of effectiveness of treatment If PaO ₂ has increased by 1.3kPa the patient can be classed as a responder
Maintain the patient in the prone position for as long as they continue to demonstrate a positive response for a maximum of 24 consecutive hours	Ensure optimal response from prone therapy
Monitor and document observations/ABG's Report significant changes immediately Compare SaO ₂ to that obtained prior to the procedure (whilst supine) if lower than that value consider returning the patient to supine position	Identify those patients that will or will not benefit from prone positioning To optimise patient oxygenation and minimise risks associated with hypoxia
Abdominal pressures should be measured regularly	Ensure the external pressure from pronation does not increase IAP and impair end organ perfusion
Resume nasal gastric feeding and aspirate 4-6 hourly as per unit protocol	Ensure adequate nutrition is maintained To prevent aspiration *Caution if patient requires continuous paralysis
Identify and document when patient is due to be returned supine	Ensure adequate staffing is available for the manoeuvre

If a patients' oxygenation status deteriorates and continues to do so for 30 minutes, they **MUST** be returned to the supine position. This does not automatically preclude them from subsequent attempts at prone positioning.

Although most patients respond quickly to prone positioning there are those who will benefit, but show a more gradual positive response. Therefore in the absence of an immediate improvement, and assuming there is no prolonged or unacceptable deterioration in oxygenation status, maintain them in the prone position for an additional 3-6 hours in order to illicit a positive response.

9.0 PICTORAL GUIDE



Figure 9.1

Patient lying supine awaiting proning manoeuvre. Ensure they are at the top of the bed.

Place slide sheet underneath the bottom sheet ready to slide right to left.

Remove ECG leads and dots and ensure all lines safe and secure throughout.



Figure 9.2

Place extra pillows across chest, pelvis and lower legs allowing space for the abdomen between pillows.



Figure 9.3

Place second sheet over the patient pairing it to the lower edges and pull it taut.

**Figure 9.4**

Roll the edges of both sheets together one side over and one under. Ensure patient is bodily tightly cocooned. Leave head exposed to manage airway.

Ensure slide sheet still in correct position and free from the rolled sheets.

**Figure 9.5**

When all staff are prepared the person responsible for the airway conducts the slide to the edge of the bed.

**Figure 9.6**

The patient is turned into a lateral position. Pause to ensure airway maintained and line security.

Each member of turning staff crosses arms over and under (one on each side) to act in a push pull manoeuvre to control the decent.

**Figure 9.7**

Continue to lower the patient prone and centralise them in the bed before the sheets are loosened.

**Figure 9.8**

Remove top sheet. Ensure pillows remain correctly positioned. Turn head to the side. Raise one arm up and one by side in swimming position.

Do not use pillow under head as this will hyper-extend the neck.

**Figure 9.9**

Alternate head and arm position.

Full tilt the bed to an elevation of 30 degrees.

10.0 REFERENCE LIST

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