**Introduction:-**

Prone positioning may be used in the Intensive Care Unit in an attempt to improve survival in patients with severe hypoxia associated with acute respiratory distress syndrome (ARDS). In a significant proportion of these patients, prone positioning will improve pulmonary mechanics and ventilation-perfusion matching resulting in an increase in arterial oxygenation. This improved physiology may be translated into increased survival.

**Scope:-**

This is a guideline to support clinical practice on the Adult ICU (AICU) and Churchill ICU (CICU), Oxford University Hospitals Trust.

**Aim:-**

Describe patients who should be considered for prone ventilation

Advise on relative contra-indications

Provide information on complications
Outline a standard technique for turning patients

**Definitions:**
- ARDS – Adult respiratory Distress Syndrome
- PaO2 – partial pressure of Oxygen in arterial blood in kPa
- FiO2 – Fractional delivery of oxygen during inspiration
- PEEP – Positive End Expiratory Pressure in cmH2O

**Responsibilities:**
Nursing/Medical staff & physiotherapists

**Guideline Content:**

**Candidates for prone positioning**

Patients who have met the operational definition for severe ARDS for less than 36 hours:

- Acute onset of respiratory signs and symptoms AND
- Bilateral pulmonary infiltrates AND
- Optimal ventilator therapy for at least 12 hours AND
- Severe Hypoxemia (a PaO2/FiO2 ratio of <150mmHg)
  - Eg a pO2 of < 12 kPa on 60% Oxygen
  - Please see appendix for more oxygen values meeting this criteria

**Contraindications**

The following are relative contraindications to prone positioning. Although it might be reasonable to commence proning patients with some of these conditions, they should be considered carefully at consultant and senior nurse level before proceeding.

- Increased intracranial pressure
- Severe Haemodynamic instability
- Uncontrolled bleeding
- Recent airway surgery including tracheostomy
- Cardiac arrhythmias likely to require pacing or defibrillation
- Significant likelihood of requiring CPR
- Chest drainage with persistent air leak
- Spinal instability
- Unstable fractures
- Recent abdominal or thoracic surgery
- Raised intra-abdominal pressure
- Active intra-abdominal pathology
• Pregnancy
• High BMI
• Invasive ventilation for more than 36 hours

Complications

Although prone positioning can consistently be achieved safely, most research suggests that significant side effect and complications may occur. In extreme cases, such as the dislodgement of ET tubes or chest drains, these can be fatal. There is some evidence that complications occur more commonly in units that rarely turn patients prone.

Proning should be undertaken with the attention to the following complications:

<table>
<thead>
<tr>
<th>Complication</th>
<th>Precaution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dislodgement of tubes, lines and drain</td>
<td>Secure carefully</td>
</tr>
<tr>
<td>Nerve compression</td>
<td>Pad vulnerable areas</td>
</tr>
<tr>
<td>Compartment syndrome</td>
<td>Pad limbs and injured areas</td>
</tr>
<tr>
<td>Venous stasis</td>
<td>Elevate head of bed 30 degrees, DVT prophylaxis</td>
</tr>
<tr>
<td>Limitation of diaphragm movement</td>
<td>Maintain unhindered expansion of abdomen</td>
</tr>
<tr>
<td>Gastric stasis</td>
<td>Consider prokinetics, post-pyloric feeding or reducing feed</td>
</tr>
<tr>
<td>Pressure sores to face</td>
<td>Pad vulnerable areas</td>
</tr>
<tr>
<td>Retinal damage</td>
<td>Relieve pressure from eye sockets, maintain adequate perfusion</td>
</tr>
<tr>
<td>Liver failure</td>
<td>Monitor LFTs and ABG, consider as cause for unexpected derangements</td>
</tr>
</tbody>
</table>

Notes

• In general it is not necessary to continuously paralyse an appropriately sedated patient (RASS of -4 to -5).
• Studies in which proning has occurred for longer sessions (16-18 hours) have reported better outcomes than those using shorter sessions (6 hours). In the absence of complications patients should be prone for 16 hours in every 24 hour period.
• Studies in which proning has occurred early in their illness have reported better outcomes than those using it later.
• A significant number of patients (6% in one study) improve with optimum ventilation to the extent that they no longer need proning. For this reason normally at least 12 hours of optimum ventilation should occur before proning.
Patients should be kept supine for 4-6 hours in between proning sessions.

In recent studies many patients appeared to improve only after several sessions so proning should not necessarily be abandoned if there is no improvement in oxygenation after the first session.

It is unclear when to stop proning patients, but a standard trial protocol is to stop if they fail to respond, develop significant complications or improve to have:
- an inspired Oxygen of less than 60%, AND
- a set PEEP of less than or equal to 10 cmH2O, AND
- a PaO2/FiO2 ratio of >150mmHg

If patients subsequently deteriorate they can be reconsidered for proning.

How to Prone a Patient & Nursing care

Resources Required:
- 1 large slide sheet
- 2 or more pillows, depending on their thickness
- Minimum 5 staff, preferably 7 staff (depending on the size and shape of patient)
- 1 additional bed sheet

Positioning of Staff:
- One member of staff is required to maintain the patient’s airway and control the positioning of the patient’s head during all the following steps.
• The person securing the airway is preferably an anaesthetist.
• A minimum of 4 (preferably 6) staff must also be equally distributed to each side of the patient to safely complete the following steps.
• A designated team leader should be designated whom is confident in the use of the following steps:

**Step 1**
• Place the mattress pump on static
• Roll patient onto side to insert slide sheet ensuring the slide sheet is completely through both sides as recommended in AICU Safe Systems of Work.

**Step 2**
• Ensure all lines attached to the patient have enough slack to complete the manoeuvre and are positioned to exit the bed past the head or feet.
• Position the patient’s arms down the side of their torso with hands facing in towards the hips.
• Place a pillow across top of chest and one across the pelvis.
• Use additional bed sheet to completely cover the patient from the shoulders downwards.
• Fold the sheet unto itself at the top so it can be unrolled to cover the top of the bed once the patient has been proned.
Step 3

- Roll the top and bottom sheet in together on both sides to tightly wrap the patient,
- Using the rolled up sheet, slide the patient across to the edge of the bed using command ‘ready-steady-slide’
Step 4
- Use the rolled up sheet to roll the patient up onto their side, whilst the staff furthest away push underneath the patient to aid the transition.
- Staff holding the top wrap alternatively change one hand from above to below and then the staff holding below change one hand from below to above, repeat for other hand.
- With the patient still on their side, the person controlling the head and airway must now reposition the head so that the patient does not ‘land’ directly onto their face and therefore risk dislodging of the ETT.
- The staff supporting the patient can now complete the roll into the prone position with the staff holding underneath pushing through and staff holding on top pulling to aid positioning.
Step 6

- The sheet underneath the patient can now be easily rolled out from beneath the patient's shoulders to prevent the face from lying directly on the mattress.
- Position the patient’s head to ensure the ETT is not occluded or dislodged.
- A rolled-up towel may be used to support the patient’s forehead. However, extreme care must be taken to avoid pressure on the eyes and hyper-extension of the neck.
- The staff supporting from the top of the patient can now complete the roll into the prone position with the staff underneath the patient pulling through to aid positioning.
- The sheet underneath the patient can now be easily rolled out from beneath the patient’s shoulders to prevent the face from lying directly on the mattress.
- Position the patient’s head to ensure the ETT is not occluded or dislodged.
- A rolled-up towel may be used to support the patient’s forehead. However, extreme care must be taken to avoid pressure on the eyes and hyper-extension of the neck.
- Regular mouth care must be performed and ETT positioned monitored closely so as to avoid pressure sores.
- Special attention must be paid to naso-gastric tubes as well.

Step 7

- The patient’s arms are placed in the ‘crawl’ position and the head and arms positions are alternated 2 hourly and pressure areas monitored closely.
- The bed should be tilted to maintain a 30 degree head up.
Returning to supine

- To return the patient onto his/her back, repeat the same steps

**Review :-**
Feb 2016

**References:-**

Prone positioning in severe acute respiratory distress syndrome.

Guérin C, et al PROSEVA Study Group

http://www.uptodate.com/contents/prone-ventilation

Prone Ventilation

David R Schwartz, Atul Malhotra, Robert M Kacmarek

Anaesthesia in the prone position.

Edgcombe H, Carter K, Yarrow S.

**Equality Impact Assessment :-**

As part of its development, this document has been reviewed for its impact on equality. No issues were identified.

**Appendix:-**
Table showing typical values corresponding to a PaO2/FiO2 ratio of <150mmHg

<table>
<thead>
<tr>
<th>% Oxygen</th>
<th>PaO2 less than</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td>8 kPa</td>
</tr>
<tr>
<td>45</td>
<td>9 kPa</td>
</tr>
<tr>
<td>50</td>
<td>10 kPa</td>
</tr>
<tr>
<td>55</td>
<td>11 kPa</td>
</tr>
<tr>
<td>60</td>
<td>12 kPa</td>
</tr>
<tr>
<td>65</td>
<td>13 kPa</td>
</tr>
<tr>
<td>70</td>
<td>14 kPa</td>
</tr>
</tbody>
</table>