Care of the Adult Invasively Ventilated Patient Protocol

Scope
- Intensive Care Unit
- Emergency Dept
- Medical
- Nursing

Responsible Department
- Intensive Care Unit

Approved By
Medical Surgical Clinical Standards

Authorised By
Group Clinical Standards Committee

PURPOSE
To provide evidence based instructions for staff in optimising care and outcomes for invasively ventilated patients, including prevention of ventilator-associated complications.

Definitions
- CCRNs – Registered nurse with post graduate qualifications in critical care.
- CPAP-PS – spontaneous ventilatory mode that combines pressure support with PEEP.
- GRV – gastric residual volume
- FiO2 – fraction of inspired oxygen
- HME – heat-moisture exchanger
- HOB – Head of bed
- ICU – intensive care unit
- I:E ratio the ratio of the duration of inspiration to the duration of expiration
- IMV – intermittent mandatory ventilation
- IPPV – invasive positive pressure ventilation
- MO – medical officer
- MV – minute volume
- NGT - naso gastric tube
- PEEP – Positive End Expiratory Pressure
- RASS Richmond Agitation Sedation Scale
- RN – registered nurse
- RR – respiratory rate
- SIMV – Synchronised Intermittent Mandatory Ventilation
- SpO2 – pulse oximetry
- VAP - Ventilator associated pneumonia
- Vt – tidal volume
- WOB – work of breathing
POLICY
- Patients receiving IPPV will be cared for by a CCRN or a RN in close collaboration with a CCRN.
- Nursing staff will manage IPPV in consultation with ICU medical staff.
- All patients requiring ongoing IPPV require referral to the duty Intensivist unless the patient is to be transferred externally within four hours of admission to the hospital.
- All patients requiring ongoing IPPV outside ICU or operating theatre require admission to ICU unless:
  - ICU admission is thought to be inappropriate by the treating specialist or the Duty Intensivist.
  - There are capacity constraints within ICU (as per the Duty Intensivist). In this case, transfer to an appropriate facility must be arranged via Adult Retrieval Victoria.
- All IPPV patients require naso-gastric or oro-gastric tube insertion.
- All artificial airways must be secured.

PROTOCOL
Preparation for Ventilation
- Prior to using a ventilator to perform IPPV, a device and circuit check must be completed according to standards laid out by the device manufacturer, by a CCRN or RN under direct supervision of a CCRN.
- A Laerdal bag must be at the bedside of all patients receiving IPPV at all times and must be checked before commencement of ventilation and after every nursing shift change. If the patient requires PEEP greater than 5cmH2O, a PEEP valve should be attached to the bagging circuit.
- Working suction equipment including a Yankeur suction tube must be at the bedside of all patients receiving IPPV at all times and must be checked before commencement of ventilation and after every nursing shift change.
- Equipment to manage accidental dislodgement of the ETT (guedel airway, intubation equipment, appropriately sized mask for laerdal bag) or tracheostomy tube (spare tubes of same and next smaller size, tracheostomy dilators) must be at the bedside or readily available for all patients receiving IPPV at all times.
- An alternate oxygen supply must be available to be used in the case of a gas failure.
- A cuff manometer.
- A HME

Ventilator Mode
- All patients require a mandatory mode of ventilation post intubation.
- The initial mode should be SIMV volume control unless otherwise requested by the Duty Intensivist.
- Unless otherwise stated by Duty Intensivist, wean to spontaneous mode once able.
Initial Ventilatory Parameters
All patients should initially have the following ventilatory support as a minimum. The CCRN or MO may elect to alter these as clinically applicable.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>FiO2</td>
<td>100%</td>
</tr>
<tr>
<td>PEEP</td>
<td>≥5cmH2O</td>
</tr>
<tr>
<td>Vt</td>
<td>6ml/kg (of ideal body weight)</td>
</tr>
<tr>
<td>IMV rate(f)</td>
<td>12 breaths / minute</td>
</tr>
<tr>
<td>Inspiratory flow</td>
<td>60lt/min</td>
</tr>
<tr>
<td>Pressure support</td>
<td>10 cmH2O</td>
</tr>
<tr>
<td>Inspiratory trigger (flow)</td>
<td>3litres / minute</td>
</tr>
<tr>
<td>I: E ratio</td>
<td>1:2 to 1:4</td>
</tr>
</tbody>
</table>

- Decelerating flow ramp (not square) if using SIMV VC on 840 ventilator
- Apnoea parameters should reflect the actual ventilatory parameters. When actual parameters are altered, the apnoea parameters should be altered to reflect these changes.
- Ensure alarm limits are appropriate for the parameters set.

Initial Goals of IPPV (unless specified by MO)
- Titrate FiO2 to minimum value necessary to achieve SaO2 ≥ 94% and/or PaO2 70 – 100 mmHg. Titrate MV by altering RR or Vt to achieve Arterial pH >7.25 and/or PaCO2 35-45 mmHg
- In patients receiving mandatory IPPV, plateau pressure ≤ 30cmH2O during an inspiratory hold procedure.
- In patients receiving mandatory IPPV, intrinsic PEEP of < 5 cmH2O during an expiratory hold procedure.
- Inform the nurse in charge and MO if plateau pressure and/or intrinsic PEEP are greater than the specified values.
- Vte corresponding to the set Vt

Choice of artificial airway
- The initial airway, unless otherwise specified by the duty intensivist, is an oro-tracheal tube.

Securing of the Artificial Airway
- Securing of the airway is mandatory.
- Until adequately secured as described below (ie. immediately post-intubation, during tube repositioning), the tube must be manually secured by hand.
- Artificial airways must be secured by hand when performing procedures with an elevated risk of accidental tube dislodgement for example, when repositioning or transferring patients or during bronchoscopy.
- The ETT can be secured in one of three ways –
  1. Adhesive tape (Sleek, Leukoplast or Transpore tape) – this is only acceptable for patients in theatre or in process of transport from OR to ICU
  2. Cotton tracheostomy tape – this is suitable if extubation is anticipated to occur within 12 hours. The corners of the patient’s mouth must be protected with the use of long term adhesive tapes such as Mepilex® foam dressing or Comfeel®. To ensure the ETT is adequately secured, there must be resistance to two adult fingers between the patient’s cheek and the cotton
tracheostomy tape. This must be assessed each 8 hours and after each patient position change.

3. All other ETTs must be secured using the Hollister® oral endotracheal tube attachment device or if the patient has extensive facial hair, the Dale® Endotracheal Tube Holder.

**NOTE.** Tracheostomy tubes must be secured as per the BH Tracheostomy Management protocol

### Assessing ETT Position
- Recommended length at teeth for oral ETT immediately post-intubation (and pre-CXR) depends upon body habitus, but the range is -
  - 19 - 21 cm female
  - 21 - 23 cm male
- The tip of the endotracheal tube needs to sit 2 cm above the carina.
- The ETT placement needs to be checked on a daily chest X-ray, unless stated otherwise by Intensivist.
- If an X-ray has occurred in the previous 12hrs, the daily x-ray is not required unless there is a change in the patient’s condition that warrants it.
- The ETT length needs to be compared to the patient’s teeth (or nare) and recorded once per shift on the observation chart.

### Repositioning of ETT
- Occurs in consultation with ICU MO.
- Two CCRN’s are required to carry out the procedure
- Explain the procedure to the patient
- CCRN 1 holds ETT with thumb and index finger cupping chin with palm of hand and maintains this position until the procedure is completed.
- CCRN 2 suctions oropharynx.
- CCRN2 suctions the airway with the closed inline suctioning device with an FiO2 of 1.0
- CCRN2 releases the ETT securing device
- CCRN2 deflates cuff with 10 ml syringe
- CCRN2 repositions ETT to desired level
- CCRN2 reinflates cuff to minimal occlusive volume (MOV)
- CCRN2 resecures ETT with securing device
- CCRN2 checks cuff pressure with manometer
- The procedure is documented in MR 94/7C

### Assessing and Preventing Mechanical Complications of the ETT
- The ETT position needs to be assessed and signs of friction or pressure areas need to be noted and documented.
- Rotation of the ETT site should be performed at least once per shift to prevent pressure areas.
- The circuit must contain a functioning HME or be connected to a humidifier.
Assessing and Maintaining Cuff Seal of Trachea

- A minimal occlusive volume (MOV) is achieved on initial inflation of the ETT cuff.
- The cuff pressure is then measured. Place the cuff valve of the ETT meter and measure the pressure. Ensure the pressure is within the 20-30mmHg range. If the pressure is <20mmHg, inflate cuff to desired pressure. If the pressure is >30mmHg use the red button on the manometer to deflate the cuff volume to desired pressure.
- The cuff pressure needs to be assessed and recorded once per 8 hours.
- If the minimal occlusive pressure is ≥ 30 mmHg or if there is a persistent cuff leak, it must be reported to the ICU MO.

**NOTE:** a cuff pressure ≥ 40mmHg places the patient at risk of tracheal mucosal injury.

Arterial Blood Sampling

- A routine ABG is indicated 15-30 minutes post initial intubation.
- There is no need for “routine” ABG analysis after the initial ABG is performed.
- Arterial blood sampling is required when there is a clinical indication, such as:
  - deterioration in O2 saturation ≤ 92%
  - A sustained increased WOB (work of breathing)
  - Clinical signs of hypoxia
  - At request of treating MO
  - Increased MV
  - Decreased Vt
  - Increasing RR
  - Significant changes in ventilator settings

**NOTE:** ABG should generally be performed at least 15 minutes after significant changes to allow for a steady state to be attained

Capnograph Monitoring

Capnograph (or end-tidal CO2) monitoring is required:

- During intubation to confirm airway position is sub-glottic.
- During transport of ventilated patient between departments.
  - At the discretion of the CCRN or the intensivist at other times. For example, for patients with significant elevation of CO2 level.

Implementing the “VAP Bundle”

- All IPPV patients require a specific “bundle” of care including:
  - Venous thromboembolism (VTE) prophylaxis.
  - Stress ulcer prophylaxis.
  - Sedation and analgesia as per Assessment of Pain, Delirium & Sedation of Intubated Patients in Intensive Care including –
    - One to two hourly assessment of sedation score.
    - Use of CCRN initiated sedation breaks.
  - Head of bed elevation to 30-45° unless contra-indicated.
  - Aspiration of gastric tube as per Enteral Nutrition in Adults
  - Assessment and documentation of tracheal tube cuff pressure at least eight hourly.
  - Performance and documentation of mouth care at least 4 hourly.
  - Daily assessment for extubation readiness.
- Use of humidified inspired gas (via either HME or Fisher-Paykel® warm humidifier).
- Replacement of ventilator circuits weekly or if soiled.
- Daily assessment of patient’s bowel function.
- Completion of the VAP checklist on MR126A each shift.

**Note:** Institution of all elements of the “VAP bundle” is required in order to effectively prevent VAP.

### Venous Thromboembolism (VTE) Prophylaxis
- Subcutaneous unfractionated Heparin 5000units Bd unless otherwise indicated.
- Alternatives include –
  - Low molecular weight heparin
  - Pneumatic calf compressors

### Stress Ulcer Prophylaxis
- Ranitidine is the initial choice for prophylaxis, initially as 50mg tds IV.
- Alternatively, a proton pump inhibitor (PPI) is used if –
  - Patient is currently being treated with a PPI or
  - Patient has active or recent gastro duodenal bleeding.

### Appropriate Analgesia and Sedation
- Refer to **Assessment of Pain, Delirium & Sedation of Intubated Patients in Intensive Care** document on PROMPT
- Sedation scoring needs to be conducted 1 to 2-hourly, using the RASS. A score of -2 to 0 is targeted unless otherwise documented by the on-duty intensivist (for example, dynamic hyperinflation, other ventilation issues, cardiogenic shock, and head injury). Use of sedation break unless specified by the duty Intensivist.

### Ensure Patient Position and HOB is at a 30 – 45 degree angle (Unless contraindicated)
- Use the VAP prevention magnetic protractor on the bed head or the VDU on the Hillrom to measure the angle of the HOB.
- While the patient is lying in bed, the HOB is to be at 30° -45°.
- During patient positioning and repositioning for pressure area care, the patient HOB can be lowered or flat.
- Once the desired patient position is achieved, HOB is to be returned to 30° -45°.
- If for any reason the HOB cannot be elevated to 30°, the HOB must still be elevated as high as possible.

### Aspiration of Gastric Tubes
Use the following protocols:
- [Enteral Nutrition in Adults](#)
- [Enteral Nutrition Guideline for ICU](#)
- [Nasogastric Tube Insertion and Management in Adults](#)
- Four hourly aspiration of gastric tube is required to determine the gastric residual volume (GRV) of the patient’s stomach.
- Aspirate via the gastric tube with a catheter tip 60ml syringe.
- Empty the contents of the syringe into a kidney dish until the stomach has been emptied.
- If GRV is 250mls, or less, return gastric aspirate back into the patient’s stomach via the gastric tube.
- If GRV is >250mls return 250mls and discard the remainder down the sink of the pan room.
- In consultation with the ICU MO aim to begin enteral nutrition (EN) within the first 24 hours as per Enteral Nutrition Guideline for ICU, unless contraindicated.

**Mouth Care**: As per the Oral Hygiene for the Invasively Ventilated Patient in ICU

- All artificial airways must be appropriately secure for performance of oral hygiene.
- Oral hygiene will commence two hours post intubation and commencement of IPPV, or once clinically stable to do so.
- Oral assessment will be performed and integrated into the overall patient assessment performed each shift.
- IPPV patient’s oral mucosa will be moistened two hourly and documented.
- Oropharyngeal (above cuff) suctioning will be performed and documented on observation chart a minimum of every four hours. The suction tube should be flushed with sterile water after performing oropharyngeal suction.
- Patients receiving IPPV will have their teeth brushed twice a day. The MO will prescribe oral chlorhexidine 0.12% or 0.2% bd on the patient’s medication chart. Oral care will be documented on MR126A to enable CCRNs to determine when intervention is next due.

**Daily Assessment for Extubation Readiness**
- Performed during duty Intensivist ICU morning ward round.
- Requirements for extubation include –
  - Neurological readiness to extubate (eg. able to obey simple commands).
  - Minimal ventilatory support (eg. spontaneous ventilation mode such as CPAP-PS, FiO2 ≤ 40%, PEEP ≤ 5 cmH2O, pressure support ≤ 10 cmH2O).
  - Ability to clear secretions (intact CNS, small sputum load, controlled pain)
  - Intact upper airway including minimal tracheal and glottic oedema as evidenced by a cuff leak on deflation of the cuff of the airway.
  - Haemodynamic stability as defined by the duty intensivist.

**Management of Suctioning via the Endotracheal Tube**
- A closed endotracheal suctioning system is to be used and replaced every 72 hours or more regularly if overtly soiled. Ensure the system is labelled with the date it needs to be changed. Record same on the observation chart.
- Suctioning of the patient’s endotracheal tube should only occur if the patient’s condition clinically warrants intervention.
- Explain the procedure to the patient and activate the pre-oxygenation and alarm silence functions on the ventilator.
- Advance the catheter down the ETT, then withdraw with suction activated
- The in line suction device should be flushed with normal saline via the one-way lavage port after suctioning.
- The suction tubing can be rinsed with tap water from a foam cup with “suction and the date used” written on it. The cup should be emptied after use to prevent spillage and changed at midnight.
- Regular suctioning without clinical indication is not recommended.
- Document the amount, colour and nature of secretions on the Observation chart

**Humidification of the Ventilator Circuit**
- Use of humidified inspired gas (via either HME or Fisher-Paykel® warm humidifier) is required.
- Warm humidification is recommended via the Fisher-Paykel® warm humidifier if patient has:
  - tenacious sputum
  - haemoptysis
  - bronchospasm
  - bronchorrhea
  - Hypothermia (temp<32°C)
- Select the temperature setting for Intubated patients on the Fisher-Paykel unit.
- The HME need to be changed as per manufacturer’s recommendations, usually every 24 hours, more frequently if soiled.

**Management of the Ventilator Circuit**
- The ventilator circuit should be changed after seven days or more regularly if soiled with sputum, blood or debris. Ensure the circuit is labelled with the date it is due to be changed.
- The presence of condensation within the circuit must be assessed each hour.
- Condensation must be drained away from the patient.
- The circuit should be supported to prevent drag on the ETT.

**Daily Assessment of Patient's Bowel Function**
- Document on the observation chart patient’s bowel function for the shift. Record bowel activity on the fluid balance summary at midnight.
- Assess patient’s abdomen and document findings
  - If bowel function is impaired, (ie. BNO ≥ 48 hours) implement aperients in consultation with MO

**Skin Integrity**
- Refer to: [Pressure ulcer risk assessment & prevention](#) protocol
  - Conduct pressure area care 2 - 4 hourly
  - Assess pressure points and determine skin integrity on admission (MR92) and once per shift thereafter.
  - Braden Risk Assessment must be performed and documented on admission and daily thereafter on MR126B
  - Document any pressure areas
  - If skin integrity impaired, document on nursing care plan and “Wound assessment and progress chart” - MR117
- Complete an incident report on the Electronic Incident Management System-VHIMS if pressure area has occurred.

- **Assessment of Eye Integrity**
  - Assess eye for dryness and scleral integrity
  - Use lubricating eye drops Poly-Tears® or Poly Visc® lubricating ointment as per product information.
  - Document and report to MO any irregularities with eye integrity

**Related Bendigo Health Policies and Protocols.**

- [Pressure ulcer risk assessment & prevention](#)
- [Oral Hygiene for the Invasively Ventilated Patient in ICU](#)
- [Enteral Nutrition Guideline for ICU](#)
- [Enteral Nutrition in Adults](#)
- [Nasogastric Tube Insertion and Management in Adults](#)
- [Assessment of Pain, Delirium & Sedation of Intubated Patients in Intensive Care](#)

**REFERENCES and ASSOCIATED DOCUMENTS:**


**MANDATORY INCLUSION**

*Personal information and health information as defined in the relevant Victorian law, which is required to be collected, used, disclosed and stored by BHCG in order to achieve the Purpose of this policy, will be handled by the Group and its employees in accordance with their legal obligations.*

*When developing this policy, BHCG has taken all reasonable steps to make its content consistent with the proper discharge of its obligations under the Charter of Human Rights and Responsibilities Act 2006.*