

# **Paediatric Intensive Care Unit Nursing Procedure:**

## **Care of the ventilated child**

All nursing staff should read this policy to inform themselves of relevant procedures before undertaking any aspect of care of an intubated/ventilated patient on PICU.

### **Standard**

- Only qualified nurses who have satisfactorily completed The Paediatric Intensive care orientation programme and competency booklet may independently care for a ventilated infant/child.
- Any concerns or marked changes to the patient's condition should be reported immediately to the medical staff and the nurse in charge.

### **Indication for Mechanical Ventilation.**

Primary indications include:

- Respiratory Illness requiring respiratory support
- Depressed or absent respiratory drive secondary to medication or central nervous system injury.
- Inadequate peripheral neuromuscular function including: phrenic nerve lesions and muscular dysfunction.
- Upper and Lower airway obstruction
- Airway protection
- Acute management of increased intracranial pressure.

### **Bedside Safety**

A full handover must be received at the beginning of the shift, including ET tube size and length, (where it is taped), If the tube is secure or mobile, Mode of ventilation, changes made and patients current condition.

It is also essential that every patient has two name bands in situ, checked with nurse taking over care, and full patient survey is performed at beginning of shift. (Handover checklist is performed and signed)

The Minimum safety requirement at each bedside must include:

1. Resuscitation equipment (Ayres T piece or waters circuit and ambu-bag with oxygen tubing attached)

Oxygen ports available and fully working.

Age/size appropriate sized silicone facemasks and Guedel airways.

3 spare ET Tubes, one the same size, one size smaller and one size bigger.

2. Suction equipment, checked and set up correctly

Appropriate sized suction catheters,

Appropriate size yankeur sucker

Parameters for suction pressures can be found in the bedside folders (PICU practice guidelines).

3. A portable oxygen cylinder must be in the bed space and must be over half full: this is for emergencies only, such as inbuilt oxygen fails or evacuation of the unit.

**These cylinders are not to be used for transport of patients to the wards.**

4. Individualised Emergency drug checklist completed and checked by medical staff.

5. Checked that the ventilator is plugged into a red socket, and has a working gas supply. The ventilator must be checked before admission. The Servo I has a pre-use checklist to be performed before use on each patient. Ensure that this is passed before use.

6. A stethoscope.

7. Monitor alarms must always be left on and set at appropriate limits, consistent with the patient's clinical condition and age.

### **Care of the patient.**

- Intubated and ventilated patients must not be left unattended. When the staff nurse has to leave the bed space, another staff member must be informed and be available to supervise.

### **Patients with a critical airway and/or receiving paralysing agents should be nursed 1:1 nurse/patient ratio and not left unattended.**

- Bed/cot sides should always be raised when the patient unattended or unless direct care is being delivered.
- The ventilation currently used on the unit is Servo I. The policy for use with these ventilation such as high frequency oscillation, Bipap via Philips V60, and infant flow drivers have separate nursing guidelines which all nursing staff must be familiar with and refer to when the nursing a patient on such equipment.
- At the beginning of each shift, the ventilator setup should be checked, ventilator alarms set and checked and a full respiratory assessment of the patient undertaking and recorded on the observation chart.
- Ventilation observations and humidification temperature are recorded hourly; other observations must be individualised to ensure the patient receives appropriate observation and documentation of care.
- Any changes made by the medical team must be documented in red pen on the observation chart
- Ensure the correct ventilator tubing is used:

For patients: **0-5kg – Neonatal (small circuit) 15mm diameter circuit.**

**5 – 40 kg – Paediatric circuit (22mm Diameter Circuit)**

### **>40kg – Adult Circuit with a HME filter attached at patient end.**

N.B. Neonatal and Paediatric circuits are wet circuits and should be humidified. Adult circuit (which are dry circuits) should be changed to wet circuits after 1 week.

- New nurses to the unit must have been assessed as competent in setting up of circuits for the ventilators.
- The water trap should be emptied when necessary and must never be above  $\frac{3}{4}$  of its capacity, once emptied the water should be disposed of to prevent the spread of infection.
- Catheter mounts should not be used in patients under 10 kgs unless requested by medical staff. This is due to the large amount of dead space these can have, hence decreasing the amount of CO<sub>2</sub> clearance.
- Manometers should be used when hand ventilating patients. These are to ensure that the peak pressure is not being exceeded.
- The circuits should only be changed when visibly soiled or mechanically malfunctioning. This should then be documented on the weekly changes sheet.
- Acute desaturation and/or loss of ETCO<sub>2</sub> trace should be regarded as a ventilator malfunction or ET tube blockage/dislodgement. Immediate action should be taken, this is disconnecting the ventilator, hand ventilate and seek assistance.

### **Humidification**

Humidification is provided by Fisher and Pakel Humidifiers on PICU.

- All humidifiers use water feed sets and 1 litre of sterile water, their level of water should be checked hourly and adjusted accordingly.

- The desired inspired gas temperature is 37 degrees C. The humidifier automatically sets this to be the inspired temperature at patient end of circuit.
- Condensation should always be present in the expiratory limb of the ventilator circuit, Please drain away condensation regularly and before turning the patient. This is to prevent bacterial colonization of oropharynx, stomach and sinuses.
- The water for humidifiers should be hung at the same level as the humidifier to prevent excess water filling into the humidifier and drowning the ventilator circuit.

### **End Tidal CO<sub>2</sub> Monitoring**

Every patient that is intubated should have CO<sub>2</sub> monitoring in place, there are currently 3 methods.

1, On the new Philips monitor (bed spaces 4 and 6) where a sample line can be placed into the ventilation circuit and attached to the module on the monitor, CO<sub>2</sub> reading will then be displayed on the screen as a wave form and digits.

2, On adults and older children an EtCO<sub>2</sub> adapter can be placed in the patients end of circuit. A capnostat lead is then placed onto the sensor, and the CO<sub>2</sub> module on ventilator, the CO<sub>2</sub> reading will be seen to the ventilator screen as in a wave form and digit.

3, With the Datex- Ohmeda monitors the CO<sub>2</sub> module is placed with the other modules, with water trap attached to module and sampling line being inserted on the patient end of tubing. This also will be shown on the screen as a waveform and digits.

- Contamination of the sampling lines by secretions, condensation or obstruction of the sampling chamber can lead to unreliable results. Subsequently it may be necessary to clean/replace CO<sub>2</sub> sensor/sampling line when this situation arises.
- A normal capnogram has a characteristic appearance that represents the various phases of carbon dioxide elimination in the lungs during exhalation. For practical purposes it should look like a square wave and if it does not it cannot be relied on to give an accurate reflection of arterial CO<sub>2</sub>. Any alterations in the visual waveform may indicate deterioration in the patient's condition and require immediate assessment.

### **Ventilation Care Bundle**

The goal of the care bundle is to prevent aspirations of contaminated secretions, hence preventing Ventilator Associated Pneumonia.

During the shift the nurse should check the following:

- Elevation of the bed between 30 – 45 degrees.

**Neonates** – 15 – 30 degrees

**Infants and above** – 30 – 45 degrees.

- If Cuffed ET tubes are being used, inflate them to maintain a cuff pressure no greater than 20cm H<sub>2</sub>O.
- Keep the ventilator circuit free of condensate by draining the water away every 2 – 4 hours
- Decontaminate hands with soap and water (if hands are visibly soiled) or with an alcohol based hand rub before and after contact with ventilator circuit.
- When contact from respiratory secretions is anticipated – wear gown and gloves before providing care to patient.
- Provide comprehensive mouth care every 4 hours (2 hourly for more high risk patients) using 0.2 % chlorhexidine as antiseptic for children over 2 months of age.
- Ventilator circuit changes should take place only when it is visibly soiled or mechanically malfunctioning.
- Change inline suction catheter systems only when soiled or otherwise indicated: Open catheter systems should be considered single use. (Change suction tubing every 24 hours).
- Store yankeur in a clean non-sealed plastic bag when not in use. (change 24 hourly)

### **General Information**

- A useful mnemonic that can be used when a patient has an acute deterioration is DOPE. This can be used in ascertaining the potential causes of airway/ventilation problems in intubated patients.

**D:** Displacement of ET Tube

**O:** Obstructed ET tube

**P:** Pneumothorax

**E:** Equipment failure.

- The first line of intubation is via oral route, this is quicker and potentially less traumatic. Only when the patient is stable and safely tolerate having their airways interrupted should nasal intubation be considered.
- Nasal intubation is preferred on PICU as it is more secure. Unless there is a good contraindication such as basal skull fracture, choanal atresia or severe coagulopathy.
- Most of the children under 12 years use an uncuffed tube, but there is a large range of cuffed tubes available on consultant/anaesthetist request. **There are also croup tubes available in size 3.0, 3.5, 4.0 and 4.5 which are a longer tube which can be used with patients with croup and epiglottitis.**
- Correct tube position is confirmed by visual rising of the chest, auscultation, EtCO<sub>2</sub> monitoring. Chest X-ray is also used to confirm the correct position above the carina. The ET tube may need to be repositioned if too low or high on the x-ray.

**N.B: If in Doubt, take it out.**

**And resume bag and mask ventilation.**

- Tube security must be ensured by the application of Elastoplast tape using the trouser technique. If the strapping is loose or saturated with secretions, Ensure that the ET tube is re-secured as soon as possible.
- If possible ensure that the ET tube is taped and the measurement documented on the observation chart.
- Avoid kinking by positioning the ET and ventilator tubing dependant to the patients position, whilst keeping in mind minimising traction/pulling on the patients tube.
- Each bed space contains an adjustable tubing holder, which must be used for greater tube support and security.
- Suctioning is to be assessed and performed according to the individual needs of the patient.
- All staff should review their patient's chest x-ray.
- Blood gases should be performed where clinically indicated. At present it is the doctors or trained staff nurses who have completed a competency assessment for arterial blood gas sampling that carry out this task. The bed side nurse must be competent in understanding the result, which are documented on the observation chart.

- The physiotherapists are a vital part of the team, attending the morning ward rounds, then visit and treat patients through the day. Paediatric physiotherapists are now on call at night, available through switch.

## **Complications**

### 1. Barotrauma/Volutrama.

1. Can develop from the use of excessive inflation pressures and/or tidal volumes.
2. Clinical signs may include deterioration in oxygenation, decreased chest expansion or breath sounds with an increased resistance to hand ventilation.

### 2. Oxygen Toxicity

1. Can develop from the delivery of inspired oxygen at greater levels than those required.

### 3. Atelectasis

- May occur when there is partial or complete volume loss in a lung or lobe, which can potentiate ventilation/perfusion mismatches.
- Clinical signs may include decreased bilateral air entry, changes on x-ray, decreased tidal volumes, increased airway pressure, increased oxygen requirements or abnormal breath sounds

### 4. Hypoxemia

- Underlying causes may be difficult to ascertain.
- Clinical signs may include cyanosis, tachypnoea, pulmonary hypertension, decrease in oxygen saturation, restlessness and agitation, marked increase in CVP or decreased PaO<sub>2</sub>.

## 5. Hypercarbia

- Underlying causes may be difficult to ascertain
- Clinical signs may include increased EtCO<sub>2</sub> or increased PaCO<sub>2</sub>.

## 6. Infection

- Can develop in the critically ill child who is already immuno compromised. Patients in PICU are exposed to numerous invasive devices and procedures predisposing patients to the risk of infection.
- Clinical signs may include an increase in core temperature, tachycardia or marked changes in ET secretions (colour and consistency)

## 7. Endotracheal tube displacement

- Can develop from accidental dislodgement by inadequate securing or due to unplanned extubation.
- Clinical signs may include decreased oxygen saturations, marked increase in air entry and chest movement, marked decrease in tidal volumes or patient verbalising sounds.

## 8. Ventilator malfunction complications

- Can develop from ventilator alarms being inactive or not functioning resulting in the lack of detection, gas and/or power supply malfunction.
- Clinical signs may include sudden deterioration in the patient's vital signs.

## **Outcome**

Oxygenation, ventilation and gaseous exchange will be maintained, optimising the potential for the restoration of effective breathing patterns and acceptable lung compliance, whilst attempting to minimise and prevent complications associated with mechanical ventilation.

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