### 1. Scope

1.1 This procedure outlines the correct practice for applying in-line nebulisation using the T-Piece during resuscitation.

### 2. Background and Definitions

2.1 5.4 Million people in the UK are affected by Asthma. Three people die every day and thousands more are hospitalised following an asthma attack.

2.2 The T-piece device was developed to enable clinicians to provide nebulisation when a patient was unable to use a standard nebuliser mask; such as during a respiratory arrest. The continued administration of salbutamol and ipratropium bromide increases the likelihood of achieving satisfactory ventilations in this group of patients, who present with extreme bronchoconstriction and bronchospasm, where ventilation can become challenging.

### 3. Guidance

#### 3.1 Indications

3.1.1 The T-piece is indicated for assisting or manually ventilating patients of any age when all of the following criteria are met:

- Respiratory compromise (respiratory rate ↓10 or ↑30 per min or outside of JRCALC paediatric limits), respiratory arrest or cardiac arrest;
- Ability to provide effective ventilations compromised by bronchospasm and/ or bronchoconstriction;

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3.1.2 In patients who experience respiratory compromise/arrest following an asthma attack, a combination of bronchoconstriction, bronchospasm and the presence of a mucus plug can prevent the delivery of effective ventilations. When squeezing the bag-valve-mask (BVM), resistance to air entry will be experienced, which may in extreme cases feel like a completely obstructed airway. Once obstruction due to a foreign body has been excluded, the use of the T-piece may help to reduce the airway resistance, and enable effective ventilations to be delivered.

3.1.3 The device may be used in conjunction with a face mask, iGel, LMA or ET tube. The appropriate method should be selected using the step wise approach detailed in Clinical Guideline CG03 - Airway Management. In line with normal airway management, a face mask (with basic airway adjuncts as required) should be used initially, with consideration of the two person technique where required. More advanced techniques should be applied as appropriate. In some cases, the extreme airway resistance will prevent effective ventilation in all but intubated patients; in these circumstances, it is advisable to attempt early intubation.

3.1.4 The Easy Cap, EMMA Capnometry or Mobimed Capnography must be used in conjunction with the T-Piece.

3.2 Contra-indications
3.2.1 None in the emergency situation.

3.3 Cautions
3.3.1 Ventilated Asthma patients are prone to barotrauma; mucous plugs may cause gas to become trapped in the narrowed airways. The gas passes behind the mucous plug but cannot escape. The patient is therefore unable to exhale completely causing a dynamic increase in end-expiratory lung volume, termed dynamic hyperinflation.

3.3.2 In order to identify hyperinflation, the clinician should carry out regular auscultation, visual checking of the chest wall and percussion. Capnography can also help the clinician identify the possibility of hyperinflation and the subsequent retention of carbon dioxide.
3.4 Equipment

3.4.1 Device features:

▲ Simple to Use;
▲ Quick to assemble - Facilitates fast nebulisation;
▲ Can be used with Mask, iGel, LMA and ET tube;
▲ Rotatable sections - Can be used on patients in sitting or supine position;
▲ Drug dosages and oxygen flow rates remain as per JRCALC guidelines;

3.4.2 The T-Piece in line nebuliser is pre packed and ready to use, (Figure 1), with a Cirrus nebuliser already attached. The new style Cirrus2 nebulisers will also fit. Oxygen tubing from any standard nebuliser mask must be used in conjunction with the T-piece.

3.4.3 Figure 1 - Assembled T Piece:

3.4.4 Although the device comes pre-packed and assembled, you should familiarise yourself with how the components are connected, in case it becomes disassembled (Figure 2). The T-Piece is formed from four separate parts:
1. Elbow with closable port;
2. Straight connector;
3. T-Section;

3.4.5 Figure 2 - T Piece Components:
3.4.6 The Elbow and T-piece section are able to rotate 360 degrees around the central connector in order to keep the nebuliser in the vertical position whether the patient is sitting or in the supine position. Therefore, regardless as to the position of the patient, optimum oxygen/medication delivery through the nebuliser should always occur.

3.4.7 Attach the BVM to the T-Section, either directly, or by using a catheter mount (Figures 3 and 4).

3.4.8 Figure 3 - With Catheter Mount: Figure 4 - Without Catheter Mount:

3.4.9 The mask, iGel, LMA or ET tube should be attached securely at the elbow (Figures 5, 6 and 7). In order for the Nebuliser to remain stable and in the vertical position, it is recommended that when using the T-Piece with an intubated patient, a catheter mount is not used. Due to the weight of the T-piece and its direct placement on the tube in this case, frequent checking of the correct placement of the tube is necessary.

3.4.10 Figure 5 - Cushion Mask Figure 6 - iGel: Figure 7 - ET Tube:

3.4.11 Where only one source of oxygen is available, attach it to the T-piece nebuliser. If two sources are available, the BVM must also be connected to oxygen.

3.4.12 The patient must be ventilated with the T-piece port (illustrated in Figure 2, item 1) closed; expired air is vented through the exhalation port on the BVM.
3.4.13 The pressure limiting valve on the BVM is set to open at 40cm H\textsubscript{2}O, and acts to prevent higher ventilator pressures being applied. The override facility on the pressure limiting valve should not be engaged in normal circumstances, as it provides for a safe ventilation pressure, prevents over inflation and subsequent baro-trauma to the lungs. However, if effective ventilations cannot be achieved due to the resistance encountered, the override function may be engaged by moving the red clip so that it lies over the valve.\textsuperscript{3} Remain cautious to the risk of barotrauma.

3.5 Using the T-piece
3.5.1 Conscious Patients with Failing Respirations
3.5.1.1 Patients who are struggling with their respirations can be assisted using the BVM and T-Piece. This can be a difficult procedure as the patient will generally be anxious and therefore the application of the mask often adds to their levels of anxiety. Where possible the compression and release of the BVM should be matched to the patients pattern of inhalation and expiration. The key is to ensure that the bag is squeezed slowly and attention is paid to the rise and fall of the patient’s chest.

3.5.1.2 As the patient will most likely be having difficulty with expiration, care should be taken not to over ventilate. Generally the rate of ventilation varies depending on the individual patient, but must be maintained at no less than 10 slow ventilations per minute, to allow for adequate expiration and to avoid hyperinflation of the lungs.

3.5.2 Respiratory/Cardiac Arrest
3.5.2.1 Ventilation should be carried out according to the Trust’s resuscitation guidelines, with extra attention paid to the rise and fall of the chest. Ventilations should be slow to allow for adequate expiration and to avoid barotrauma.

3.6 Capnography and Gas Trapping
3.6.1 End tidal CO\textsubscript{2} monitoring must be used in accordance with Clinical Guideline CG11. The sampling chamber must be inserted between the T-piece and the BVM, to minimise potential interference caused by the nebulised particles (Figures 8 and 9). Even with this positioning, there is still a potential risk that the sampling chamber may become contaminated nebulised particles; clinicians must be alert to erroneous readings.
3.6.2 Figure 8 - Mobimed: Figure 9 - EMMA:

3.6.3 Elevation of the baseline indicates that there is incomplete inhalation and/or exhalation (Figure 10). Carbon dioxide is not being completely washed out during inhalation. This is often seen with ‘air trapping’ in patients with a history of asthma or COPD. Elevation of the base line can also occur when there is a malfunction in the exhalation valve of the BVM. Increasing expiratory time will help remove excess CO₂ in patients who are experiencing air trapping.

3.6.4 Figure 10 – Baseline Elevation:

3.7 Cleaning and Decontamination
3.7.1 The BVM, mask, any airway adjuncts and the T-Piece are single use, and must be disposed of as contaminated (orange bag) waste.

4. Incident Closure
4.1 All patients who have received treatment using the T-piece must be admitted to the nearest Emergency Department, with an ATMIST pre-alert placed.

5. Documentation
5.1 In line with Trust Policy, a Patient Clinical Record must be completed and annotated appropriately. There is currently no specific tick box within the record for the T-Piece, therefore its use should be documented within the notes section. Any deviation from this guideline must be recorded, with any potential or actual adverse event reported through the incident reporting system.
6. References

1. Asthma UK. http://www.asthma.org.uk/about-asthma/ [01/10/12].
