ADMINISTERING NEBULISED ANTIBIOTICS

PRACTICE GUIDELINE ©

DOCUMENT SUMMARY/KEY POINTS

- It is important that the **correct nebuliser system** is used when administering nebulised antibiotics. Refer to the pictures at the end of this document.
- All nebulisers used in hospital for antibiotics **must have a filter attached**.
- You must ensure your nebuliser set up has an **expiratory outlet** (see pictures of nebuliser set ups in section 4 (CHW) and section 5 (SCH)).
- **Nebulised antibiotics at home** do not need a filter but the Homecare Guidelines must be closely followed to ensure there is an expiratory valve incorporated into the nebuliser system that is being used.
  - Refer to **Giving Nebulised Antibiotics at Home Homecare Guideline**: http://webapps.schn.health.nsw.gov.au/epolicy/policy/6164
- If a patient has been prescribed nebulised antibiotics you should **contact the relevant CNC** for further advice.

CHANGE SUMMARY

- Photo section of the nebuliser set for SCH (section 5), and for CHW (section 4) have been updated to reflect new nebuliser equipment being used.

Approved by:	SCHN Policy. Procedure and Guideline Committee	
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Team Leader:	Clinical Nurse Consultant	**Area/Dept**: Cystic Fibrosis

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READ ACKNOWLEDGEMENT

- All Nursing staff caring for patients receiving nebulised antibiotics while in hospital should read and acknowledge this document.

TABLE OF CONTENTS

1 Why Do We Nebulise Antibiotics?

- The advantages of nebulised antibiotic therapy for respiratory tract infections has been recognised for many years. An antibiotic delivered directly to the site of infection should be most effective, as it provides sputum concentrations well above the minimum inhibitory concentrations (MICs) necessary to achieve a bactericidal effect. These levels cannot be reached by intravenous administration without considering the high risk of systemic toxicity. Aerosolising antibiotics are unlikely to cause systemic adverse effects such as ototoxicity or nephrotoxicity with aminoglycosides, due to reduced systemic absorption.
- Nebulised antibiotics are used for the treatment of respiratory tract infections caused by bacteria (such as *Pseudomonas aeruginosa*) for which there are few suitable oral antibiotics. They can be used intermittently to treat an acute infection (a course is usually one month), or as a part of a regular medication regime for patients with chronic chest infections. It is crucial the nebuliser being used can produce a small enough particle size to depress the medication into the lungs effectively. See section 4 for equipment and detail/photos for CHW, and section 5 for equipment and details/photos for SCH.
- Bronchospasms are a potential side effect of nebulising some medications, a test dose in a supervised environment is recommended when starting a new antibiotic. See section 2.1 for further details.

2 General Principles

- When using a nebuliser for the first time, explain the procedure to the child and parent/carer.
- Fresh solutions should be prepared for each inhalation treatment and any solution remaining in the nebuliser bowl following treatment should be discarded.
- *Filters must always be used* when administering nebulised antibiotics in hospital. (Refer to section 4 (CHW) and section 5 (SCH) for pictures of nebuliser set up).
- The minimum amount of solution for effective use of the nebuliser is 2 mL to a maximum of 5 - 8 mL: check the nebuliser product guide.
- Air, running at 4 – 6 L/minute, should be used when administering nebulised antibiotics, unless oxygen is specifically ordered. (If using a nebuliser different from the one suggested – Flaem RF7 Plus, check the recommendations for that device).
- Considering the child's age and developmental stage, a sealed face mask or mouthpiece should be selected. For children who are developmentally able and can maintain an adequate seal (usually children over 5 years), a mouthpiece is considered the best delivery method; otherwise, a facemask should be used; you need to ensure there is an expiratory valve in this setup, your filter is your expiratory valve. (For children with an ETT or tracheostomy, refer to Section 4 for pictures of the required setup).

- The clinical indication may also influence the choice of interface e.g. using a facemask and nasal breathing to facilitate upper airway deposition of antibiotic. A dedicated sinus nebuliser could also be considered in this instance.
- The child should rinse out their mouth following the administration of nebulised antibiotics where possible.
- Nebuliser equipment should be washed after every use. Separate nebuliser parts before washing in warm soapy water, rinse well and place parts on a piece of dry, clean paper towel to dry. Nebuliser equipment should not be reassembled until all parts are completely dry. NB: the nebuliser tubing and filter pads should not be washed.
- If the patient is on more than 1 nebulised medication, it is important to have a separate nebuliser bowl for each medication.
- Not all antibiotics can be/are appropriately nebulised. This varies between different drugs as well as different brands within the same drug. Check with the Pharmacy to ensure an antibiotic is appropriate for nebulisation.

NB: The filter should be changed when you start to see medication/mist coming through it – about every 2 – 4 days. If a child indicates that it is difficult to breath out this could indicate a blocked filter so change the filter.

2.1 First Dose of a Nebulised Antibiotic

Due to the risk of bronchospasm, the first dose (or test dose) of a nebulised antibiotic should be given in a supervised environment (e.g. on the ward, or in the respiratory function laboratory). Monitoring to detect significant bronchospasm should ideally include:

- Spirometry performed before and after the test dose, with monitoring of oxygen saturations during the test dose.
- If spirometry is not possible (e.g. poor technique due to young age or cognitive impairment), then oxygen saturations should be monitored during the test dose.
- The child's chest should also be auscultated for wheeze before and after the test dose.
- Monitor for changes in work of breathing.
- The patient is deemed to have failed the test dose if there is:
  - A 10% fall in actual forced expired volume in 1 second (FEV1) from baseline.
  - Development of audible wheeze on auscultation
  - Significant decrease in oxygen saturations, defined as a ≥3% decrease below the pre-test baseline level.
  - A significant increase in work of breathing or paroxysmal coughing.
- If the test dose is not tolerated (as per guidelines above), administer salbutamol (typically salbutamol 100 microgram MDI inhaler 4-6 puffs via spacer) and if the above changes

normalise within the following 15 minutes (FEV1/Oxygen saturations return to baseline/wheeze resolves) then salbutamol pre-treatment for future doses of that nebulised antibiotic should be given (typically salbutamol 100microgram MDI inhaler 4-6 puffs via spacer 10 minutes prior to dose).

- If the patients FEV1/oxygen saturations do not return to normal within 15 minutes, or wheeze persists, continuing treatment with the nebulised antibiotic should be discussed with the treating team.
- If an outpatient is to be started on a nebulised antibiotic and cannot be supervised during their first dose, give salbutamol pre-treatment 10 minutes prior (typically salbutamol 100 microgram MDI inhaler 4-6 puffs via spacer) to each dose of the nebulised antibiotic until a dose can be given supervised using the protocol above.
- Treatment with nebulised antibiotic should be stopped if the patient displays any paroxysmmal coughing, shortness of breath or audible wheeze and the parent should seek local medical review and contact their CNC to discuss ongoing treatment.

NB: The respiratory lab will only be responsible for doing the lung function testing; a nurse must escort the patient to the respiratory lab to administer the nebulised antibiotic, or the respiratory technician can attend the patient bedside or clinic room to perform spirometry.

3 Equipment and Procedure

Note: The general principles around nebulising antibiotics are the same whether a patient is on Non-Invasive Ventilation (NIV), closed circuit ventilation or no assisted ventilation, however the setup is different for each – refer to section 4 (CHW) or section 5 (SCH) for pictures of nebuliser set ups.

- Nebuliser: (with tubing), sealed mouthpiece or mask, filter set with a T piece (see pictures in section 4 (CHW), Section 5 (SCH)). All equipment is available from your hospital's Inhalation Therapy department.
    - NB: If the nebuliser you are using comes with a mouth piece with an expiratory valve e.g. Flaem RF7 nebuliser (with blue expiratory valve), this mouth piece should be replaced with a mouth piece that has no expiratory valve when a filter is being used, but it should be kept (do not throw away) as it may be needed for continued treatment at home if a filter is not used (Refer to Giving Nebulised Antibiotics at Home Homecare Guideline)
- Prescribed antibiotics
- 3 or 5 mL Syringe and a drawing up needle (if needed)
- Sodium chloride 0.9% or water for injection (if needed)
- Appropriate PPE when giving via tracheostomy

3.1 Procedure

1. Prepare patient by explaining procedure to both child and parent, role of medication and any potential side effects.
2. Open top of nebuliser and ensure the nebuliser bowl is empty and clean.
3. Prepare medication, check you have the correct medication and check expiry date:
    i. **If medication is in a plastic ampoule**: twist off top, if the whole ampoule is needed squeeze contents into nebuliser, if only part of the ampoule is needed, using a syringe with a needle attached, draw up the correct amount of medication and then put into nebuliser.
    ii. **If medication is a liquid in a glass ampoule**: carefully snap off the top of the ampoule, using a syringe with the drawing up needle attached draw up the correct amount of medication and place into the nebuliser.
    iii. **If medication is in a powder form:** Using a drawing up needle and syringe draw up correct amount of water for injection, add to glass vial shake till powder is completely dissolved, withdraw required amount of medication and put into nebuliser.

    NB: To allow effective operation of the nebuliser the total amount of the fluid in the nebuliser should be at least 2mL, but not more than 5 – 8 mL (check the nebuliser product guide). If the medication is less than 2mL, add sodium chloride 0.9% to the nebuliser to make a total minimum of (medication plus sodium chloride) 2mL.
4. Close the cap/top on the nebuliser, ensure the filter system is attached (as pictured in section 4 (CHW) / Section 5 (SCH)).
5. Connect the tubing to the nebuliser and wall air outlet, place the sealed mask on child or mouthpiece in child's mouth, turn on air flow to between 4 – 6 L/min (this may differ if not using the recommended Flaem RF7 nebuliser – check manufactures recommendations)
6. Run the nebuliser for 10 – 20 minutes until there is no longer mist being produced, and/or there is no medication remaining in the nebuliser bowl.
7. Turn off wall air outlet, remove nebuliser mask/mouthpiece from child and clean equipment. Nebuliser and mouth piece should be rinsed out after every use, wash in warm soapy water and place parts on a piece of dry, clean paper towel to dry (do not put nebuliser back together until completely dry).
8. When the medication is finished, rinse the child's mouth with water and have them spit the water out (where possible). This helps remove any antibiotic which may be coating the mouth and also decreases the incidence of oral thrush, which is sometimes associated with nebulised antibiotic treatments.

For tracheostomy patients, without ventilator support, disconnect heat moisture exchange (HME) (e.g. swedish nose) if appropriate and connect nebuliser to tracheostomy tube via flexible tubing if available. Ensure the weight of the nebuliser is supported so as not to pull or drag on the tracheostomy tube. When the nebuliser has stopped producing mist reconnect the HME/ humidifier to the tracheostomy.

NB: The nebuliser, T piece and mouth piece/mask (see pictures in section 4 (CHW)/ Section 5 (SCH)) should be returned to inhalation therapy once the patient no longer needs it, as some parts can be disinfected and reused.

NB: Children requiring nebulised antibiotics may also be receiving Humidified High Flow Nasal Cannula Therapy. There is a special set up for these circuits as per the policy.

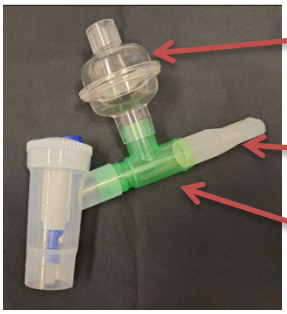
NB: At CHW, for ventilated patients in PICU refer to 'Non-Invasive Ventilation in PICU" Guideline.

4 Nebuliser Set-up CHW (using the FLAEM RF7 nebuliser)

NB: When using the FLAEM RF7 nebuliser ensure the button on top is pressed so 'max' side of button is up as per picture

4.1 Patients who are self-ventilating

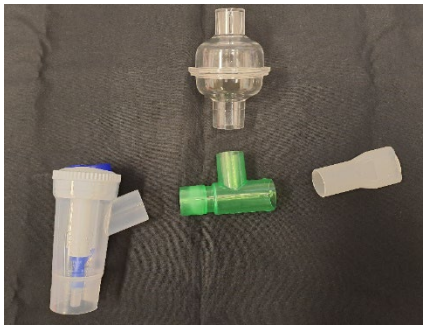
With a mouthpiece



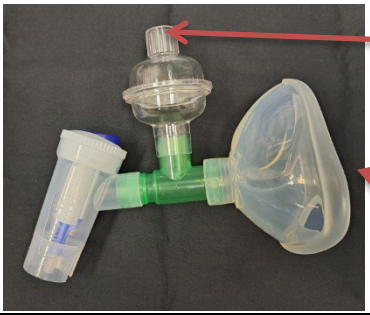
Filter (is also the expiratory outlet)

Mouthpiece (no expiratory valve when filter used)

T piece



With a mask



Filter (is also the expiratory outlet)

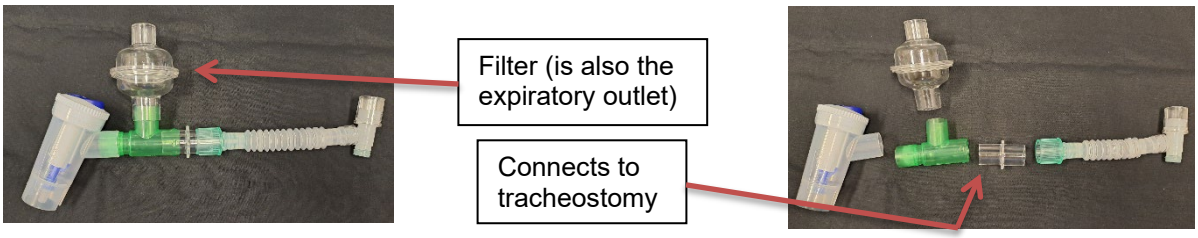
Sealed Mask (different sizes available from Inhalation Therapy)

Note: The filter is also your expiratory outlet.

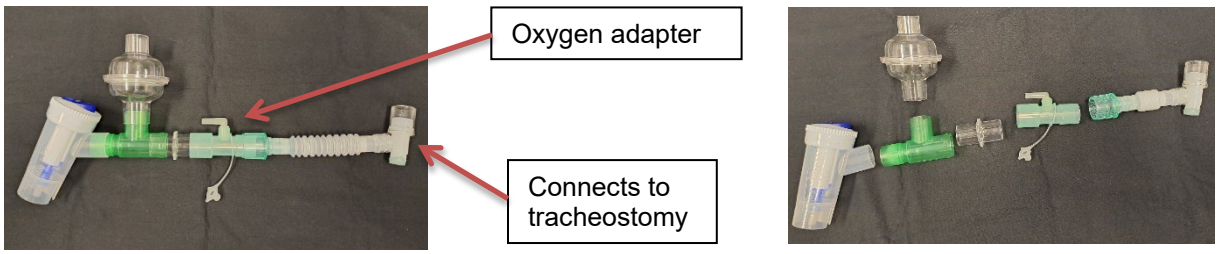
- All parts pictured above are available from CHW Inhalation Therapy.
- The following mask can also be used; however parents need to purchase this from the CHW Appliance Centre.

Need to ensure the expiratory valve/flap on the mask is pushed *in:* it is not needed as the filter is the expiratory outlet.

4.2 Patients with Tracheostomy (not requiring ventilator assistance)



If oxygen is required to be given at the same time as the nebulised medication, the oxygen adaptor must be placed in the circuit between the filter and the patient as demonstrated below.



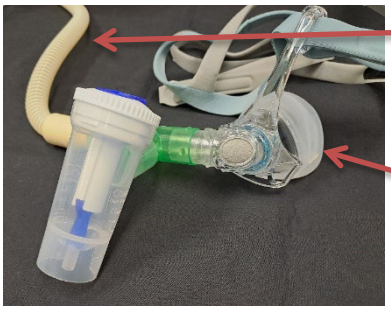
NB:	The filter is also your expiratory outlet

- All parts pictured above available from CHW Inhalation Therapy.

4.3 Patients on non-invasive ventilation (NIV) (BIPAP, CPAP)

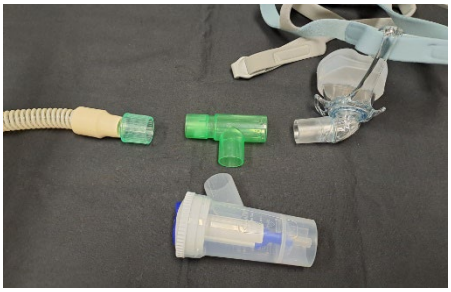
It is not possible to filter the antibiotic from the environment in a set up with CPAP/BIPAP as the CPAP/BIPAP mask has its own built in expiratory outlets, therefore, if a patient can be removed from their CPAP/BIPAP during nebulisation of an antibiotic this should be done – but only with consultation and approval from the medical team involved. If a patient cannot be removed from their CPAP/BIPAP during nebulisation of an antibiotic the set-up should be as pictured below.

Note: The antibiotic is not being filtered from the environment so the patient should be placed in a single room or the treatment room during nebulisation to reduce exposure to other patients where possible.

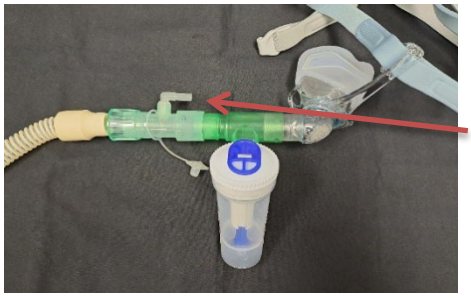


CPAP/BIPAP tubing

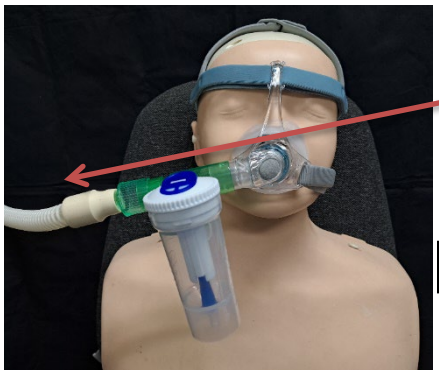
Patient should have their own CPAP/BIPAP mask. Has a built-in expiratory outlet



If oxygen is required to be given at the same time as the nebulised medication, the oxygen adaptor must be placed as demonstrated below

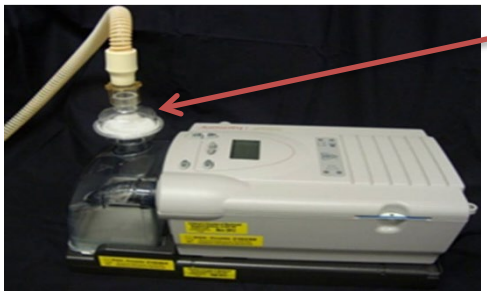


Oxygen adapter



Connects to CPAP/BIPAP machine

CPAP/BIPAP tubing

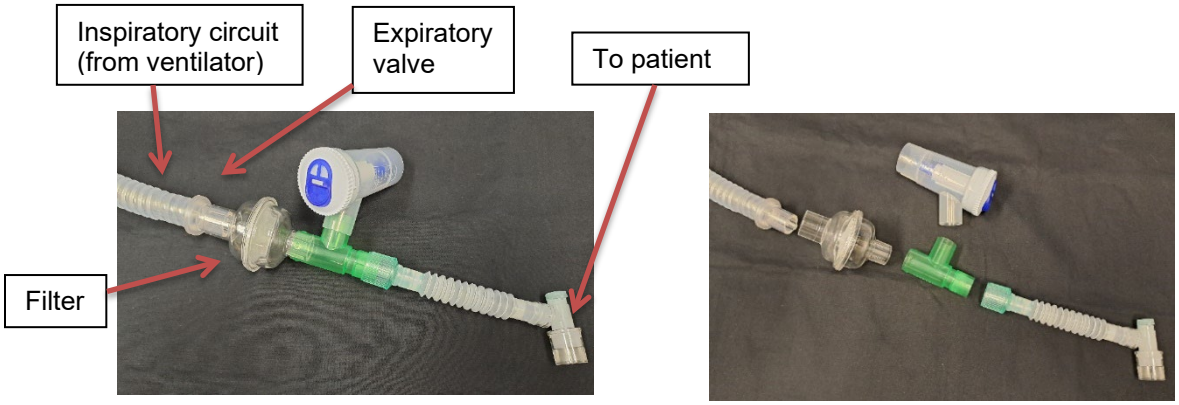


FILTER: If the patient is using a loan BIPAP/CPAP machine there should always be a filter on the circuit to protect the machine. If the machine is owned by the patient (so not ever used by another patient) there only needs to be a filter on the circuit during the time in which an antibiotic is being nebulised to protect the machine.

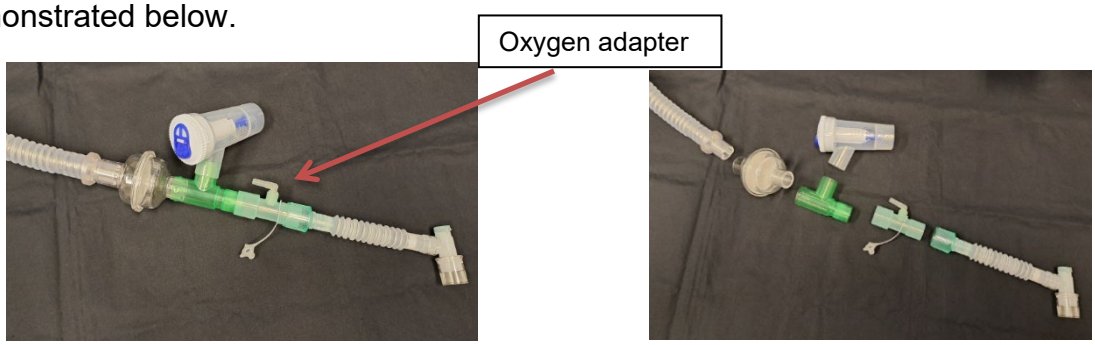
The filter is best placed where the BIPAP/CPAP tubing connect to the machine.

Note: All parts pictured above are available from CHW Inhalation Therapy (except mask with strap & BIPAP/CPAP machine: patients should have their own, and may vary in style from the one pictured)

4.4 Patients on closed circuit ventilation



If oxygen is required to be given at the same time as the nebulised medication, the oxygen adaptor must be placed in the circuit between the filter and the patient as demonstrated below.



NB: The filter may alter the positive end expiratory pressure (PEEP). Please ensure the filter is removed when the nebuliser is complete

For **assistance with setting up a patient who is ventilated**, should discuss with the Sleep medicine/long term ventilation (LTV) CNC, the physiotherapist (if known to child on ward) or the PICU nurse practitioners if the patient is in PICU.

General points to note

- All nebuliser equipment pictured is available from Inhalation Therapy (patients on NIV will have their own mask with strap).
- The nebuliser, T piece, mouthpiece and masks should be returned to Inhalation Therapy following use (once patient is discharged or treatment ceased). If a patient takes the nebuliser home to continue treatment you must ensure the original mouthpiece with the expiratory valve or a suitable mask with an expiratory value is placed on the nebuliser. Refer to Giving Nebulised Antibiotics at Home Homecare Guideline.
- For patients who are admitted regularly for administration of nebulised antibiotics they should be encouraged to bring their nebuliser equipment with them for continued use in

hospital. The FLAEM RF7 nebuliser should be replaced after one year's use. New nebulisers can be purchased by families for home use from the Appliance Centre.

- Refer to the 'instructions for use' leaflet for full use and recommendations when using the FLAEM RF7 nebuliser.

NB: The nebuliser set up described above can also be used for medications other than antibiotics; however, a filter system (as described and pictured above) would not be required so you must ensure the nebuliser has an expiratory valve.

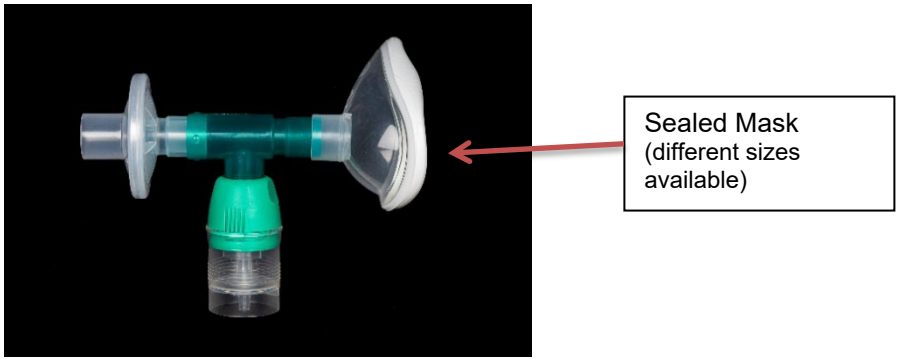
Refer to the Homecare Guideline on "Giving Nebulised Antibiotics at Home" for pictures of different set-ups with an expiratory valve (without a filter).

5 Nebuliser set up SCH

5.1 Patients who are self-ventilating

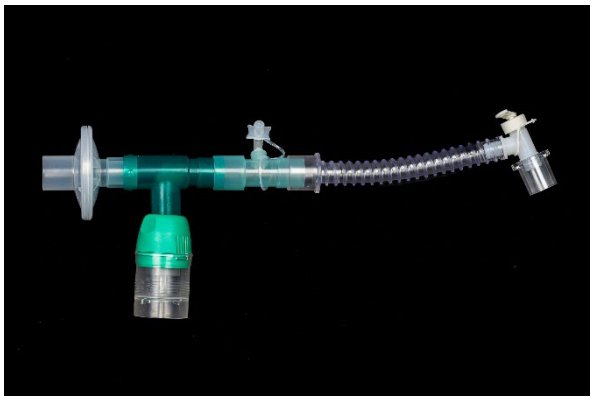
With a mouthpiece

With a mask



Note: The filter is also your expiratory outlet.

5.2 Patients with Tracheostomy (with and without oxygen connector)

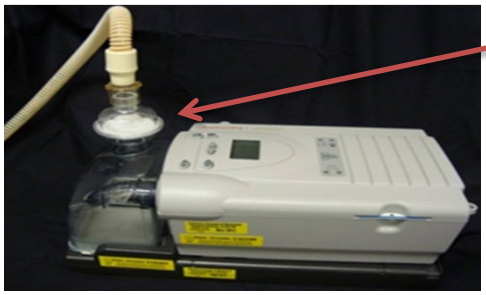


5.3 Patients on non-invasive ventilation (NIV)

It is not possible to filter the antibiotic from the environment in a set up with CPAP/BIPAP as the CPAP/BIPAP mask has its own built in expiratory outlets, therefore, if a patient can be removed from their CPAP/BIPAP during nebulisation of an antibiotic this should be done – but only with consultation and approval from the medical team involved. If a patient cannot be removed from their CPAP/BIPAP during nebulisation of an antibiotic the set-up should be as pictured below.

Note: the antibiotic is not being filtered from the environment so the patient should be placed in a single room or the treatment room during nebulisation to reduce exposure to other patients.

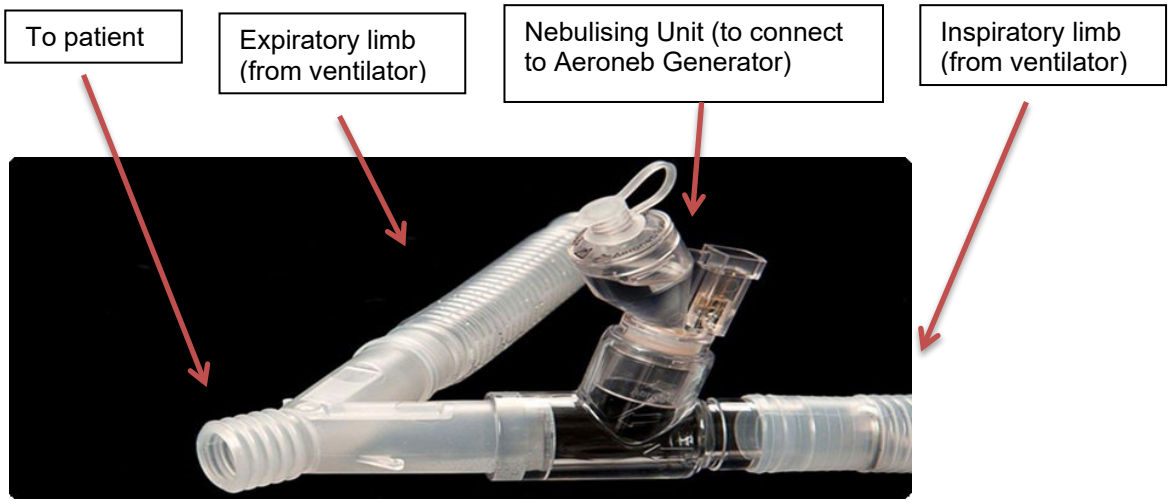
The AeroNeb is a vibrating mesh nebuliser. The nebuliser unit itself is single patient use only. It is most often used with the Servo-i ventilator, but can by used with a mask or a mouthpiece or in the circuit of any ventilator. There are three in-line "t" adaptors, for neonatal, paediatric and adult circuits, which are autoclaved between patients. The nebulising unit will hold up to 6 mls of fluid and can be used as an intermittent or a continuous nebuliser.



FILTER: If the patient is using a loan BIPAP/CPAP machine there should always be a filter on the circuit to protect the machine. If the machine is owned by the patient (so not ever used by another patient) there only needs to be a filter on the circuit during the time in which an antibiotic is being nebulised.

The filter is best placed where the BIPAP/CPAP tubing connect to the machine.

5.4 Patients on closed circuit ventilation



Equipment Availability:

- Cirrus nebulisers are available through the physiotherapy department and C2S.
- Nebuliser circuits for children with a tracheostomy are available on C2South.
- Patients admitted regularly for the administration of nebulised antibiotics should be encouraged to bring their nebuliser equipment with them for continued use in hospital.
- Aeroneb equipment for use with non-invasively ventilated patients is available through Children's Intensive Care.

NB: The nebuliser set up described above can also be used for medications other than antibiotics; however, a filter system (as described and pictured above) would not be required so you must ensure the nebuliser has an expiratory valve.

6 Homecare Guideline

If the patient takes the nebuliser home for continued use, ensure they are sent home with a mouthpiece or mask with an expiratory valve on it. Refer to:

- Giving Nebulised Antibiotics at Home: http://webapps.schn.health.nsw.gov.au/epolicy/policy/6164

7 Bibliography

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