

Respiratory System

NEBULISER TYPES AND USE

Nebulisation transforms a solution of a drug into a fine mist for inhalation. This method delivers higher doses of a drug than can usually be achieved by inhaler devices. The fine mist produced is breathed in by the child during inspiration via a close fitting face mask, tracheostomy mask or mouth piece. Nebulisation therapy may be part of the acute care for the child in respiratory distress or used for the chronically ill child with a long term respiratory condition.

There are two main ways of delivering nebulised therapy:

Jet nebuliser: Uses an extrinsic gas flow (whether piped oxygen, air or compressed air via a nebuliser compressor) forced through a narrow orifice to create a pressure that draws a drug from a liquid as a mist.

Ultrasonic nebuliser: Uses high frequency sound waves to produce small droplets from a liquid containing a drug as a fine mist.

These nebulisers are able to achieve different particle sizes of aerosol. Ultrasonic nebulisers may achieve a particle size of 1-2 microns. This is small enough to reach the alveoli. Jet nebulisers however may achieve 1-5 microns which may be too big to reach the alveoli but will be able to reach the bronchioles. This particle size is therefore appropriate to treat asthma and croup. Jet nebulisers are most commonly used in hospitals via piped oxygen set at 6-8litres/minute. Children with severe or life threatening asthma should receive frequent doses of nebulised bronchodilators driven by high flow oxygen.

Procedure:

- Undertake a complete nursing assessment of the child's respiratory status.
- Consider what pre procedure preparation the child may require:
 - Use of play specialists.
 - Demonstration of procedure and listening to the nebuliser using a mannequin or child's chosen toy.
 - Discuss age appropriate rewards (e.g. certificates and stickers) to promote confidence and self-esteem after the procedure.
 - Identify a suitable area for nebulisation.
- Obtain Informed consent from the child and/or parent/guardian. This will involve explaining what a nebuliser is, its indications, contraindications and side effects.
- Emphasis should be placed upon the child and parent being in control of the procedure as much as possible.
- Prepare the nebuliser solution you will require. (You may need to dilute the drug with sodium chloride 0.9% to achieve a minimum volume, normally 2.5ml).
- Nebulised drugs should not be mixed and given simultaneously unless expressly instructed on the prescription sheet and interactions confirmed because some drugs can interact with one another.
- Check the drug in accordance with the '5 rights':
 - The right patient
 - The right drug

- The right dose
 - The right route
 - The right date and time
- Ensure the child is sitting comfortably upright to allow for maximum lung expansion.
- Undertake a pre nebuliser peak flow recording if the child is clinically and developmentally able to do this.
- Put the nebuliser solution in the nebuliser 'acorn', attach the oxygen tubing at the bottom of the acorn and to your piped oxygen supply and comfortably fit the facemask over the child's nose and mouth.
- Increase the oxygen flow gradually to achieve 6-8l/min, or turn on the compressor if using compressed air to drive the nebuliser.
- Allow the nebuliser to run until almost all of the fluid has disappeared:
 - There will be a residual volume, check with the specific manufacturer's instructions to ascertain how much.
 - This should take approximately 10 minutes.
- Undertake a complete nursing assessment of the child's respiratory status post nebuliser.
- Wash and dry the nebuliser pot after use in accordance with the manufacturer's instructions.
 - Nebuliser consumables are usually single patient use, not single use only.
- Undertake a post nebuliser peak flow recording if the child is clinically and developmentally able to do this.
- Consider post procedure follow up:
 - Use of play specialists
 - Post procedure discussion
 - Provide any promised rewards
- Document fully how the child tolerated the procedure ensuring care plans are updated with the specific child's preferences.

Commonly Nebulised Drugs for Children

Diagnosis	Nebulised Drug	Considerations	Side effects
Exacerbation of asthma	Salbutamol (beta2 agonist Bronchodilator)	Must be driven by oxygen in acute exacerbation of asthma 6-8 litres/minute	Tremor, headache, peripheral vasodilation, tachycardia, arrhythmias, hypokalaemia
	Ipratropium Bromide (Antimuscarinic Bronchodilator)	Must be driven by oxygen in acute exacerbation of asthma 6-8 litres/minute	Dry mouth, nausea, headache, Tachycardia, palpitations, hypersensitivity Can cause pupil dilatation if aerosol enters eyes.
Severe Croup	Adrenaline (Alpha and beta adrenoceptor agonist properties)	Close monitoring required. The effects of adrenaline last for up to 3 hours. Obstruction may reoccur after this period. Must be driven by oxygen 6-8 litres/minute	Tachycardia, arrhythmias, nausea, palpitations, hypertension, dyspnoea, pulmonary oedema.
	Budesonide (corticosteroid)	Candidiasis may be avoided if you clean the child's teeth or rinse mouth with water after nebulisation. Must be driven by oxygen 6-8 litres/minute	Hoarseness, candidiasis, adrenal crisis, hypersensitivity, bronchospasm, anxiety.
Chronic respiratory purulent infection e.g. Cystic Fibrosis	Colistin (Antibacterial)	Protection against gram negative organisms. Often administered by nebuliser compressor.	Neurotoxicity with high doses, hypersensitivity
	Dornase Alpha (Mucolytic)	Reduces sputum viscosity or 'stickiness' Normally used pre physiotherapy. Often administered by nebuliser compressor. Mouthpieces should be used so the drug does not deposit on the child's face.	Pharyngitis, chest pain, occasionally rashes, urticaria, conjunctivitis.
Acquired Immune Deficiency Syndrome	Pentamidine (Prophylaxis of pneumocystis pneumonia in a child with AIDS)	An alternative to oral co-trimazole if the child is unable to tolerate this. Toxic so will require caution in handling. <i>Nebuliser solution not licensed for use in children.</i>	Bronchoconstriction, cough, shortness of breath, discomfort.
Tracheostomy/palliative care	Normal saline 0.9%	Loosens secretions. Normally used pre physiotherapy. Often administered by nebuliser compressor.	

Practice Tips for Children:

- Show the child the nebuliser before its first use and demonstrate the noise it will make, young children are often frightened by the sudden noise of a nebuliser.
- A good position for nebulisation is to hold the child on the parents lap, facing them towards the parent with their head on/over the parents shoulder. The nebuliser face mask can then be held close to the child's face behind the parent. This position allows for optimum lung expansion, reduces anxiety and causes minimal disruption to the sleeping child.
- If a child is in respiratory distress and have positioned themselves sitting upright do not attempt to move them. Nebulise where they are comfortable. The child may well be compensating and moving them into the 'optimum position' may cause deterioration.
- If a child has a silent chest a nebuliser will bring out a wheeze, this is a very good sign and parents should be reassured as such. This means there is now some audible air entry into the lungs.

Pitfalls:

- If the child cries throughout the nebuliser they will tire very easily so will need close monitoring.
- However! Young children don't like nebulisers. If they tolerate the procedure very well be suspicious they are compensating and monitor them very closely.
- The proportion of drug that actually reaches the lungs during nebulisation can be as low as 10%. The solution that does not reach the lungs is left in the acorn as residual volume or forms droplets on the tubing, facemask and on the child's face.
- Face masks should be an appropriate size or mouth pieces used to minimize nebulised particles near the eyes.
- *In England and Wales nebuliser compressors for use with jet nebulisers are not available on prescription on the NHS. (They are available in Scotland). For children who require nebulised therapy at home nebuliser compressors may be loaned by their paediatric community nursing team, GP or specialist respiratory nurse.*

Further Reading:

- BMJ (2009) BNF for children. London, BMJ.
- The British Thoracic Society (2009) British Guideline on the Management of Asthma. London, British Thoracic Society.