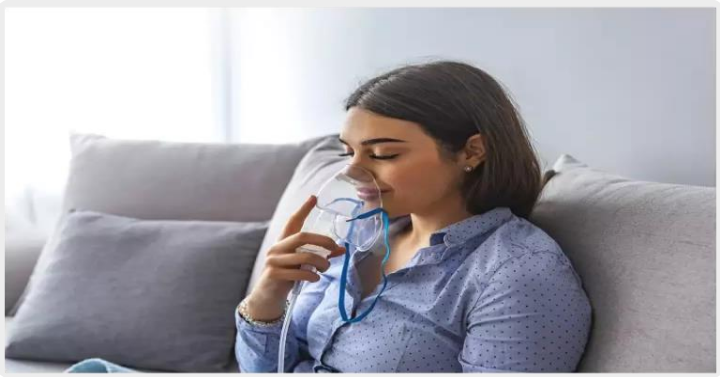
Using A Nebulizer in Asthma



By: Dr. Mozhgan Moghtaderi

Nebulizer is a drug delivery device used to administer medication in the form of a inhaled into the lungs.

An aerosol is a mixture of gas and solid or liquid particles.

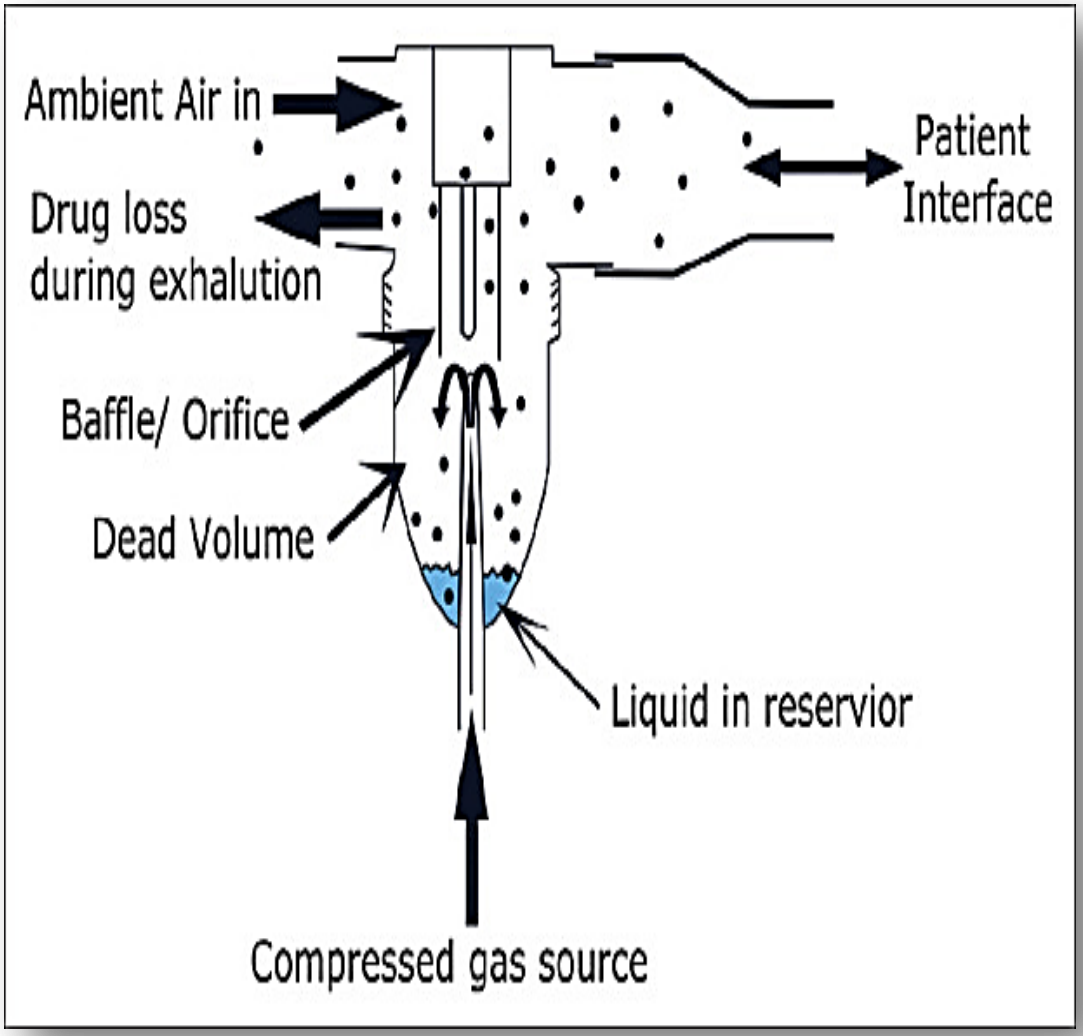
Nebulizer therapy

Appropriate for:

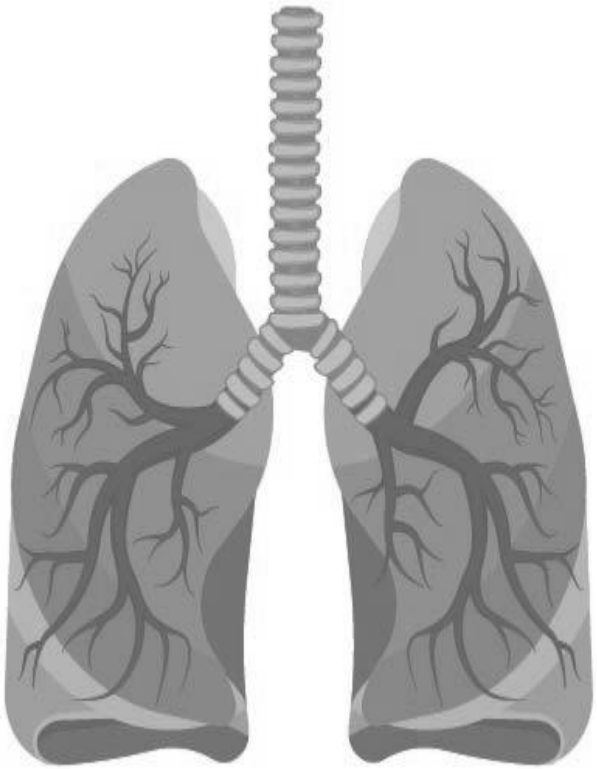
Different types of Nebulizer based on technology

- Jet Nebulizer
- Ultrasonic Nebulizer
- Mesh Vibrating Nebulizer

Jet Nebulizer

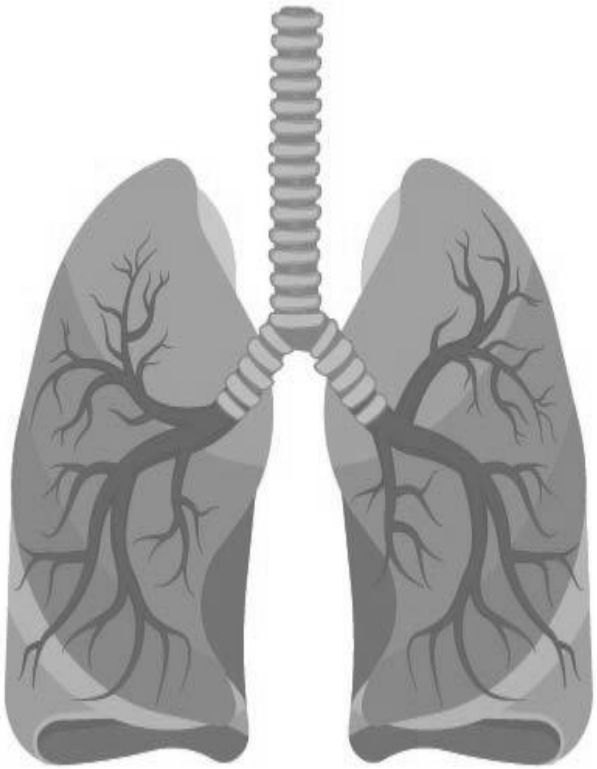


The fundamental concept of nebulizer performance is the conversion of the medication solution into droplets in the respirable range of 1-5 micrometers. (MMAD, mass median aerodynamic diameter))



During inspiration & expiration:
30-40% trapped in nebulizer
>60% wasted with exhalation

< 10% availability to patient



Reservoir fill volume is (3 to 5ml, NaCl).

A the end: remain 0.5 to 1.5 ml, referred to dead volume.

Time often is 10 to 25 minutes.

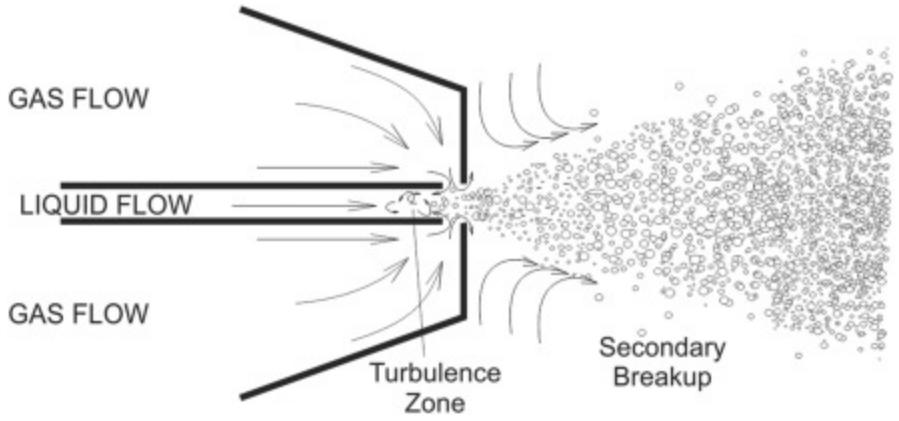
Mouthpiece

Face mask for treatment of acute ill or uncooperative patient such as infants and toddlers .

Face mask with vent holes should be used , which will reduce deposition on the face and in the eyes.

Gas flow and pressure, affect nebulizer performance and drug delivery gas density

Higher flows produce smaller particle size droplets and reduce medication delivery time.
This is true when using higher driving pressure to operate the device. Devices that are designed to be operated using a higher pressure source may not be suitable for home use



jet nebulizers (pons)

commonly used in hospitals for patients who have difficulty using inhalers, such as in serious cases of respiratory disease, or severe asthma attacks.

The main advantage is related to its low cost- Durable

Production of aerosol with little effort on the patient

jet nebulizer (cons):

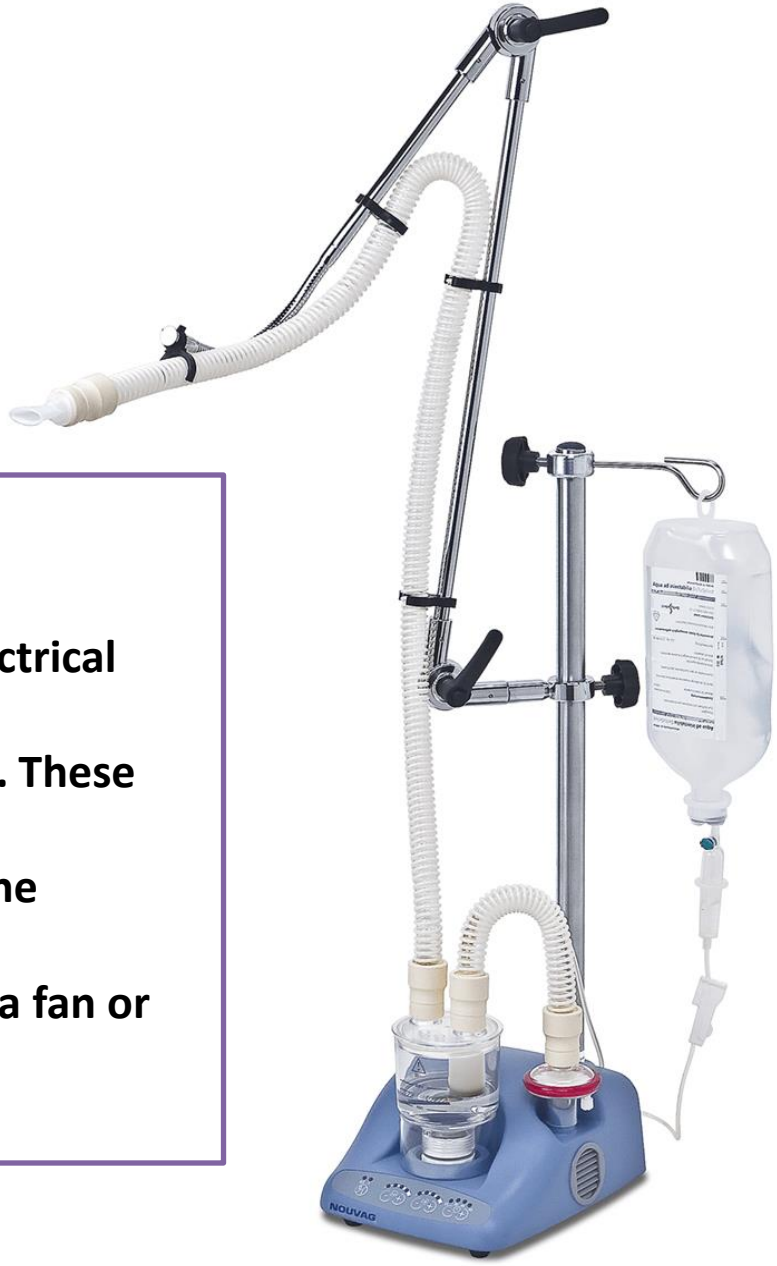
-generates a lot more noise (often 60 dB during use)

-is less portable due to a greater weight.

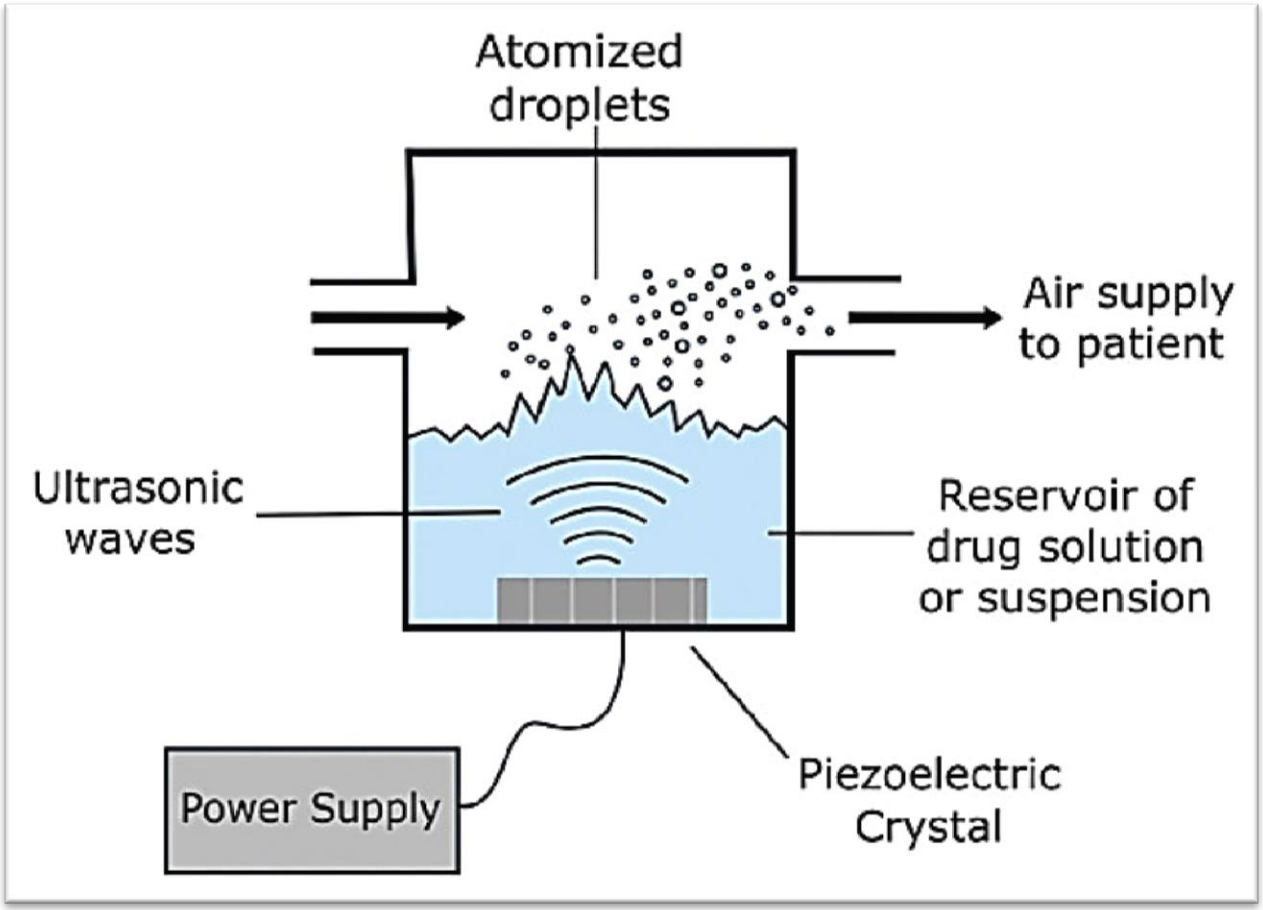
Today several manufacturers have also managed to lower the weight of the jet nebulizer to 635 grams and started to label it as a portable device.

An ultrasonic nebulizer

Generates high-frequency ultrasonic waves from electrical energy via a piezoelectric element in the transducer. These ultrasonic waves are transmitted to the surface of the solution to create an aerosol. Aerosol delivery is by a fan or the patient's inspiratory flow.



Structure of an ultrasonic nebulizer



Particle sizes may be larger with this device. MMAD= 2 to 12µ
Output is 2 to 3 times higher than jet nebulizer

Heat is produced along with the aerosol, this maybe adversely affect heat-sensitive medication such as protein. Pulmicort Respules cannot be used with nebulizer units that generate heat, as is the case with most ultrasonic nebulizers

A limitation of ultrasonic nebulizers is that they do not nebulize suspensions efficiently.

Ultrasonic nebulizers (pons)

Large amount of aerosol release, quiet, and noise free

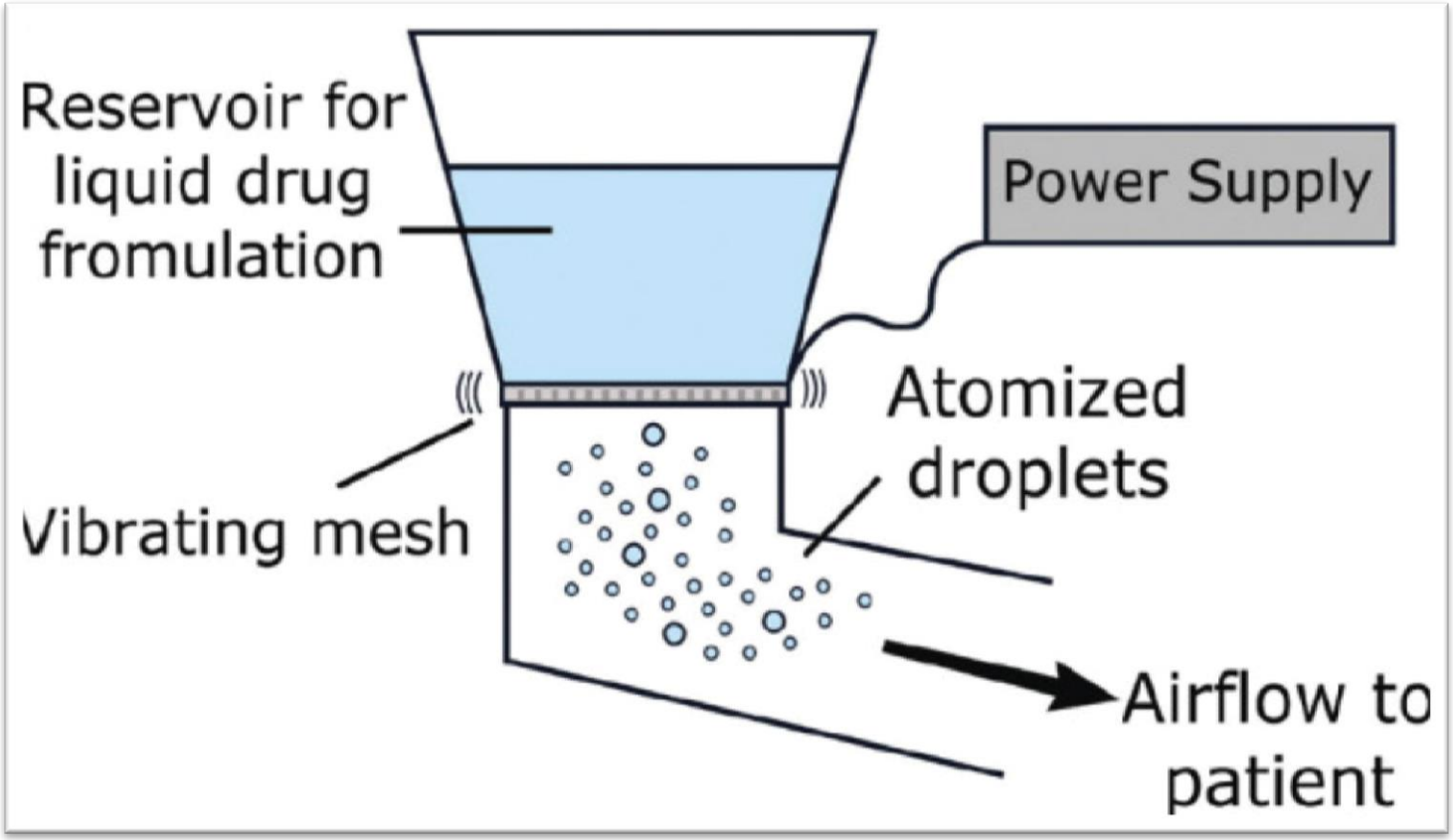
Ultrasonic (cons):

-Requiring power (generally AC power)

-Easy drug degeneration, Easily affect suspensions

Mesh Vibrating Nebulizer

A new significant innovation was made in the nebulizer market around 2005, with creation of the ultrasonic Vibrating Mesh Technology (VMT).



Mesh Vibrating nebulizers (pons)

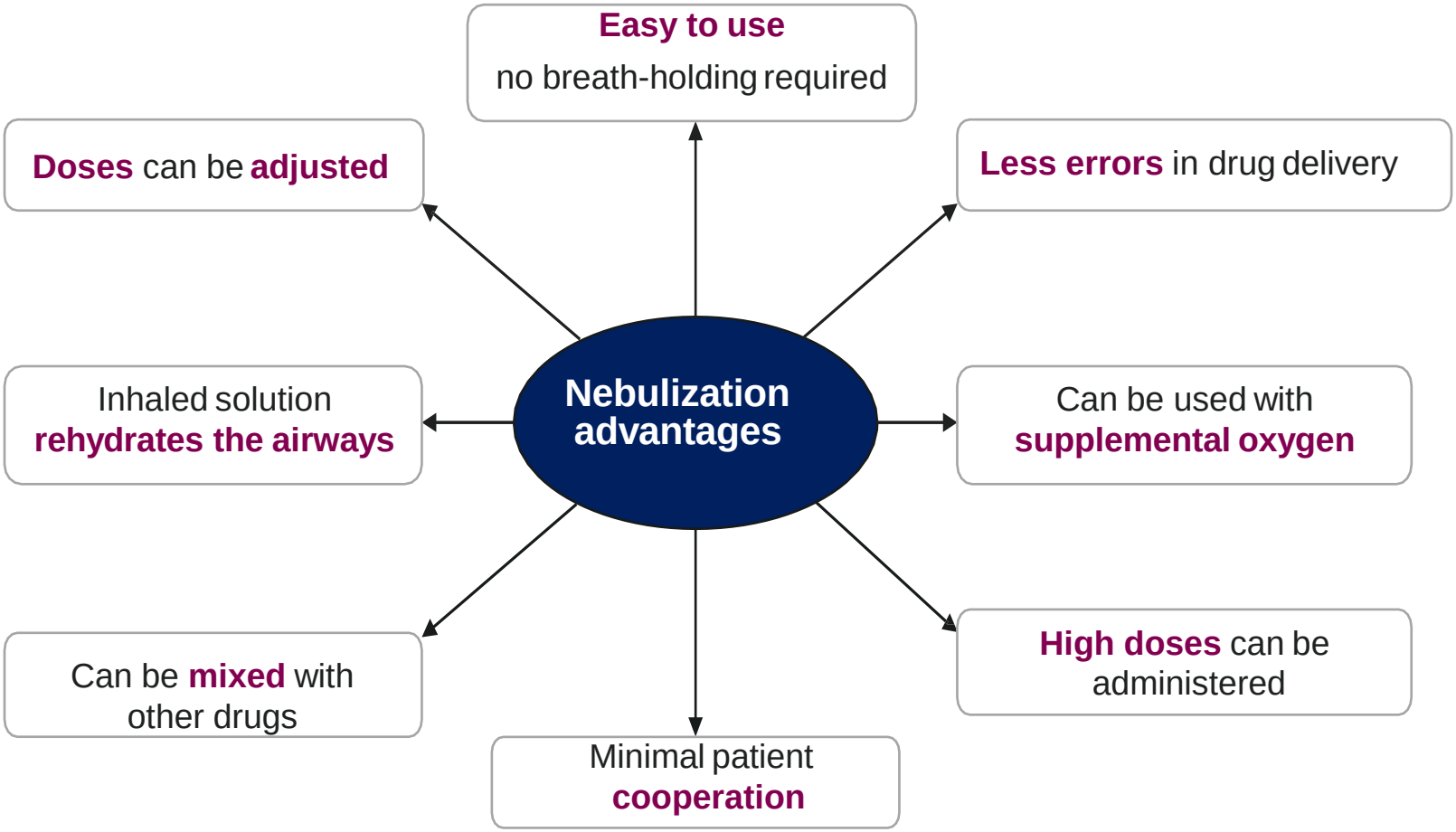
Quiet and noise free, lightweight, battery-driven
Liquids can be placed above the breathing tube, without any backflow preventing contamination from the solution in the tube
No undesired heating of the medical liquid

Mesh Vibrating (cons):

Durability has not been confirmed, and there are limited types to choose from- Disinfection
Expensive

- Technology
- Time of nebulization (low is better)
- Air pressure: 0.8 to 1.4 bar or 0.2 till 0.5
- Accessories (adult and child mask, filter N=10, nose piece, mouth piece)
- Disinfection capability
- Bag
- Evaporation capability: 0.3 cc /min or 0.4cc /min
- Electrical capability

Nebulization has many advantages for asthma



Disadvantages of using a nebulizer

- Poor portability
- Treatment time
- More expensive
- Need for power force
- Infection

Inhalation Solutions Often Used with Nebulizers

Drugs	Concentration
Salbutamol Ventolin Asthalin	 2.5 mg in 2.5 mL 2.5 mg in 2.5 mL
Budesonide (Pulmicort Respules)	0.25, 0.5, or 1 mg/2 mL
Doulin (ipratropium bromide and levosabutamol)	2.5 mL 500 µgIB + 1.25 SAL
Ipratropium Bromide (Ipravent)	2 Ml 100µg
Antibiotics (Tobramycin or tobamist)	300 mg/ 5 mL
L-epinephrine	0.5mL/kg with max=5 mL

Albuterol Respule in children

0.15mg/kg each 20 minutes for 3 dose with minimum dose 2.5 mg

Then 0.15 to 0.3 mg /kg up to 10 mg every 1-4 hours as needed.

0.5 mg/kg/hour by continuous nebulization

Albuterol Respule in adults

2.5- 5 mg each 20 minutes for 3 dose with
Then 2.5- 10 mg every 1-4 hours as needed.
10-15 mg/hour by continuous nebulization

Pulmicort Respules

Generic Name: budesonide inhalation suspension
Brand Name: Pulmicort Respules
Drug Class: Corticosteroids, Inhalants

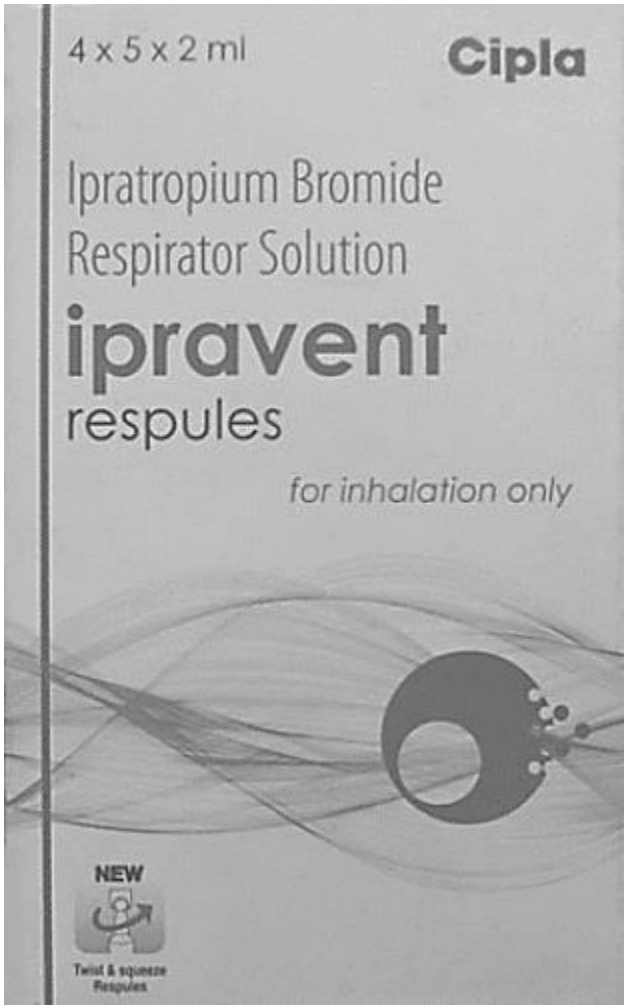
Should be administered via jet nebulizer with an adequate air flow.
Ultrasonic nebulizers are not suitable for the adequate administration of PULMICORT RESPULES and, therefore, are NOT recommended.

Adults (including the elderly and children 12 years and older): 0.5 - 1 mg twice daily.

Children 3 months to 12 years: 0.25 - 0.5 mg twice daily.

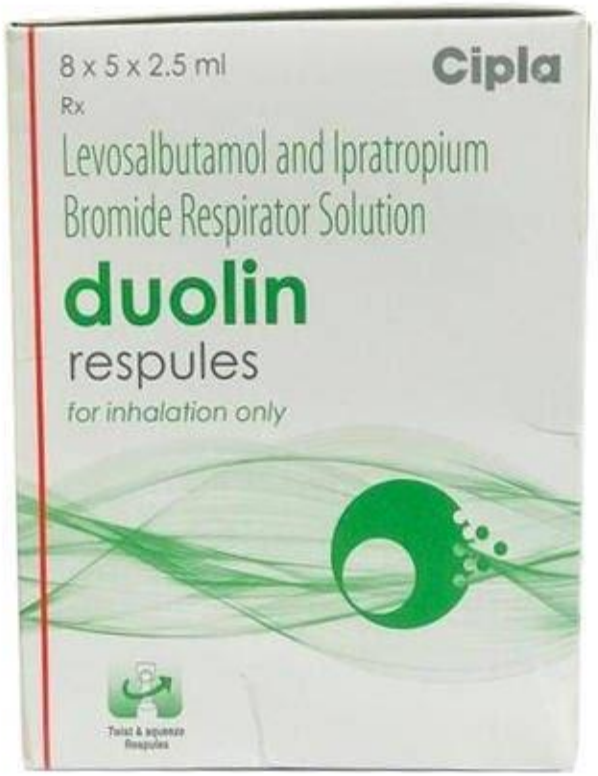
Russian Expert Pediatric Consensus; place of nebulized inhaled corticosteroid in asthma exacerbations therapy

Severity of exacerbations	**Treatment with Budesonide**
Mild	0.5 mg 2 times/day for 5-7 days, then lower the dose for 50%
Moderate	0.5 mg 2 times/day until symptom's resolution
Severe	1 mg 2 times/day until symptom's resolution



0.25mg /mL
Children:0.25 to 0.5 mg every 20 minutes for 3 doses, then as needed
Adult: 0.5 mg every 20 minutes for 3 doses, then as needed

Levosalbutamol and Ipratropium Bromide



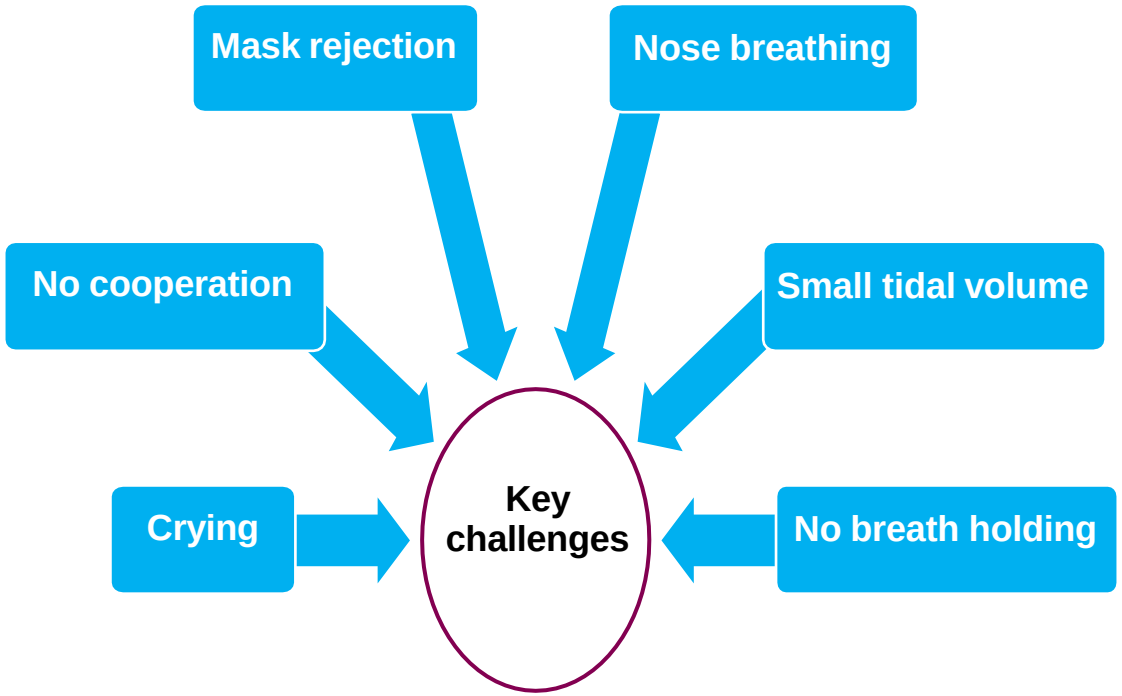
1.25 mg and 500 µg

Adults & children more than 12 years: One respule three times a day , every 6 to 8 hours

Nebulizer is equal with pMDI + spacer

Young children are especially challenging to treat

Several factors should be taken into account in the administration of inhaled therapy in i**nfants and young children**, as they can affect the **dose delivered** to the lungs.



Elderly patients are especially challenging to treat

Patients with severe asthma

Edetate disodium (EDTA) and benzalkonium chloride (BAC) are often present as preservative or stabilizing agents in nebulizer solutions used to treat asthma and chronic obstructive pulmonary disease.

For spontaneously breathing patients with a tracheostomy tube
use a T-piece interface with the jet nebulizer without additional gas flow given by the oxygen system

A clear guidance on the use of nebulization during the pandemic

Consensus

International expert opinion on the use of nebulization for pediatric asthma therapy during the COVID-19 pandemic

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Introduction

Asthma treatment and management guidelines are being updated in response to the current coronavirus disease 2019 (COVID-19) pandemic. While the updated guidelines broadly agree in their recommendations of asthma medication, guidance on the use of nebulizers for the delivery of asthma medication is contradictory (1-5). Nebulizers generate aerosol particles 1–5 μm in size, which can carry viruses into the lungs (6). The risk of infection transmission via droplet nuclei and aerosols may increase during nebulization owing to the potential generation of high volumes of respiratory aerosols that may be propelled over a longer distance than in natural dispersion patterns (7,8). Additionally, large aerosolized particles may stimulate a cough reflex in both patients and bystanders and thus increase transmission risk (7,9). Based on these potential risks, concerns have been raised regarding the possibility that nebulizer use in patients with COVID-19 infection could transmit potentially viable infection to susceptible bystander hosts. However, existing data are limited and of poor quality (10) and so it remains unclear whether nebulization poses a transmission risk for severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2).

Guidelines differ on how to address this uncertainty. Some, including those from Global Initiatives for Asthma (GINA), the Australian Commission on Safety, and Quality in Healthcare and the Canadian Thoracic Society recommend avoiding the use of nebulizers in asthma treatment where possible (1-3,5). By contrast, recent guidelines from the National Institute for Health and Care Excellence (NICE), UK and the New and Emerging Respiratory Viral Threat Assessment Group (NERVTAG) advise that the use of nebulizers can be continued since the aerosol generated during nebulization comes from a non-patient source (the fluid in the nebulizer chamber) and therefore does not contain virus particles derived from the patient (11,12). Position statements from the French Language Respiratory Society (SPLF) and the Haute Autorité de Santé (HAS) support the continued use of all asthma medications provided relevant safety measures for healthcare providers (HCPs) and relatives are maintained during nebulization (4). The contradictory guidance from the above societies could leave treating physicians unable to provide clear advice on optimal therapy plans to their asthma patients. This poses a particular problem for pediatricians as nebulization is the only suitable treatment

Avoid nebulizers where possible, to reduce the risk of spreading virus

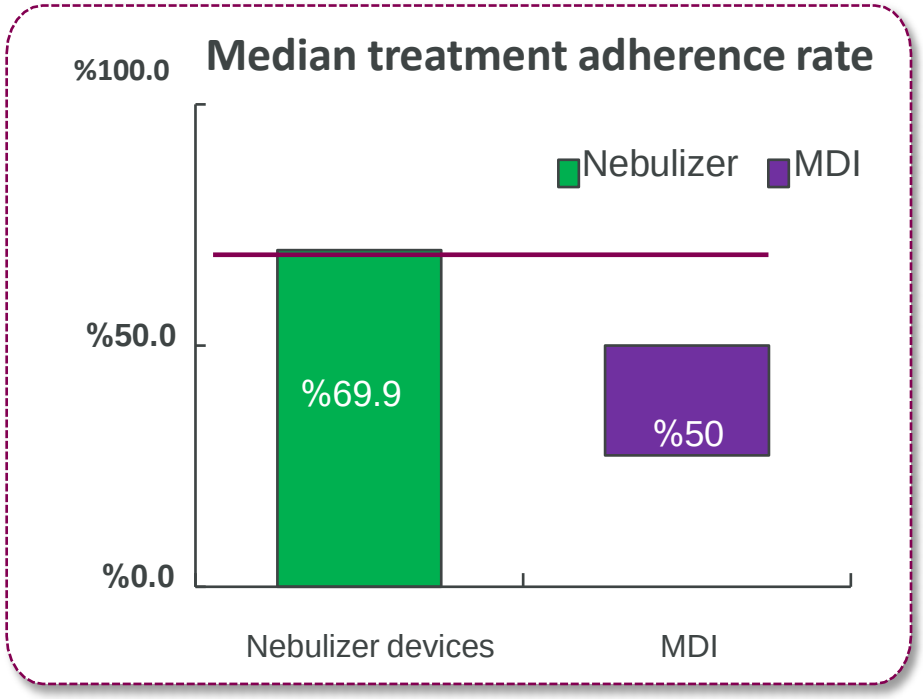
Follow strict infection control procedures if aerosol-generating procedures are needed

GINA 2021

International expert opinion on the use of **nebulization for pediatric asthma therapy** during the COVID-19 pandemic

Home nebulization improves patient compliance due to ease of use

- **Research type:** Multi-Center, prospective, observational study
- **Recruitment** :0-14 years children with asthma and prescribed Home Neb ICS for ≥3 months, N=510
- **Primary endpoint:** Asthma control improvement.



- The median treatment adherence rate reported by **portable home nebulizer devices** was .**69.9%**
- WHO reported that the mean adherence to MDI was approximately .**50%**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