Aerosol Drugs and Humidity

Humidifiers and HMEs, choosing a nebulizer, mucoactive and inhaled anti-infective drugs, sequence and stopping rules

ICU Basics
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HUMIDITY AND HUMIDIFIERS

Inspired gas reaches 37 °C and 44 mg H_2O/L just below the carina. Humidity deficit = 44 − delivered absolute humidity; an artificial airway bypasses the nose's heat and moisture exchange.

DEVICE	USE	WATCH
Bubble humidifier	Low-flow O_2; consider above 4 L/min	Pop-off whistles if tubing kinks
Heated humidifier	Ventilator, HFNC, NIV	33–44 mg/L at 34–41 °C at the Y
Heated-wire circuit	Less rainout	Drain condensate away from patient
HME	Short-term ventilation, transport	Adds dead space and resistance
Large-volume nebulizer	Trach collar, bland aerosol	Mist must persist on inspiration

SAFETY Switch an HME to a heated humidifier for thick, copious or bloody secretions; exhaled volume under 70% of delivered; temperature under 32 °C; minute ventilation over 10 L/min; low-tidal-volume ventilation; or NIV.

CHOOSING AN AEROSOL GENERATOR

Inhaler technique and in-line ventilator delivery: see PFTs and Oxygen Delivery.

DEVICE	STRENGTH	LIMIT
Jet nebulizer	Any solution; cheap	0.5–1 mL left behind; adds flow
Vibrating mesh	Little residue; adds no flow	Cost; never touch the mesh
Ultrasonic	Large volume for sputum induction	Not for suspensions or proteins
pMDI with valved chamber	Fast; equals a nebulizer in asthma	Mask under about age 4
Dry powder inhaler	No propellant or spacer	Needs a fast, forceful breath

MUCOACTIVE AND BLAND AEROSOLS

AGENT	USE	KEY POINT
Hypertonic saline 7%	CF; non-CF bronchiectasis	Bronchodilator first
Hypertonic saline 3%	Sputum induction	Booth or negative-pressure room
Dornase alfa 2.5 mg daily	CF only	Never mixed; harmful in non-CF
Acetylcysteine 20%, 3–5 mL	Thick secretions	Bronchospasm: give with albuterol
Sterile water, saline	Bypassed airway; upper-airway edema	Water can cause bronchospasm

- AARC 2015: no routine acetylcysteine or bronchodilators to clear secretions, none for postoperative atelectasis, and no mucoactive aerosols for neuromuscular weakness.
- Dornase is given by jet or approved mesh nebulizer, not ultrasonic.

INHALED ANTI-INFECTIVES AND SPECIAL DRUGS

DRUG	REGIMEN	PRECAUTIONS
Tobramycin (CF)	300 mg twice daily, 28 days on, 28 off	Last in the sequence; not mixed
Aztreonam (CF)	75 mg three times daily by its own mesh	Bronchodilator first
Pentamidine	300 mg every 4 weeks, Respirgard II	Negative pressure, filter, TB screen
Ribavirin	SPAG-2, 12–18 h a day	Teratogenic: scavenge; no pregnant staff
Epoprostenol	Continuous mesh on the ventilator	Clogs filters; never stop abruptly

EXAM TIP Bronchodilator first before anything that provokes bronchospasm (acetylcysteine, hypertonic saline, pentamidine, aztreonam); inhaled antibiotic last, onto airways that have just been cleared.

SEQUENCE, RESPONSE AND STOPPING

- CF order: bronchodilator, hypertonic saline, dornase, airway clearance, then inhaled antibiotic or steroid.
- Judge response: breath sounds, peak flow or FEV_1 before and after, heart rate, SpO_2, sputum. No indication or no response: recommend stopping.
- Stop for a sharp heart-rate rise, new arrhythmia, chest pain, paradoxical bronchospasm, desaturation or severe tremor.
- Inhaled steroid thrush or hoarseness: valved chamber, rinse and spit, antifungal; keep the controller.
- Teach by return demonstration (teach-back), not 'do you understand?'

SAFETY Between treatments on one patient, rinse the nebulizer with sterile water and air-dry it; fill only with sterile fluids. Contaminated nebulizers have caused pneumonia outbreaks.

Sources (19) are listed with links at icubasics.com/sheets/rt-aerosol-humidity.html. For education and exam preparation only. Not medical advice; follow current guidelines and your institution's protocols. ICU Basics is an independent study aid not affiliated with any certifying body.