AerICU®

Consider Aerogen as your aerosol drug delivery solution for the Intensive Care Unit (ICU)

Aerosol drug delivery is a widely used therapeutic strategy in the ICU[1]

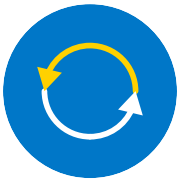
Given the complexities of treating the the critically ill patient, appropriate device choice is important, with many factors to consider.

Aerogen®

The ICU is a challenging environment in which to administer aerosolised medication

Fugitive emissions are an important concern

The need to open a pressurised ventilator circuit to administer aerosolised medication is considered a potential risk factor for the release of fugitive aerosols.[†2-4]



With jet nebulisers, the compressed gas used to aerosolise medication may exacerbate the dispersal of device- and patient-derived aerosols during nebulisation.[5]

Expert consensus states that interrupting the ventilation circuit to administer medication can increase the risk of airborne infections for healthcare professionals and patients.[4,6]

Your chosen aerosol drug delivery device must be able to work across multiple respiratory and ventilatory support setups

To avoid disruption to oxygen delivery and ventilation, it is preferable to administer medical aerosols in-line via the respiratory support setup, such as high-flow (HF), non-invasive ventilation (NIV) and invasive mechanical ventilation (IMV).[1]

It can be challenging to deliver medical aerosols in-line due to the interference of flows and positive pressure.[1]

Device factors and patient characteristics influence the efficacy of aerosol drug delivery

“Factors that impact aerosol delivery include patient characteristics, breathing parameters, the severity of airway disease, the characteristics of aerosol devices, their integration into respiratory support devices and the interface of these devices to patients, their ease of use, and patient comfort.”[1]

Aerosol therapy in adult critically ill patients: a consensus statement, 2023.[1]

Aerogen is a closed-circuit aerosol drug delivery system,[2,7]

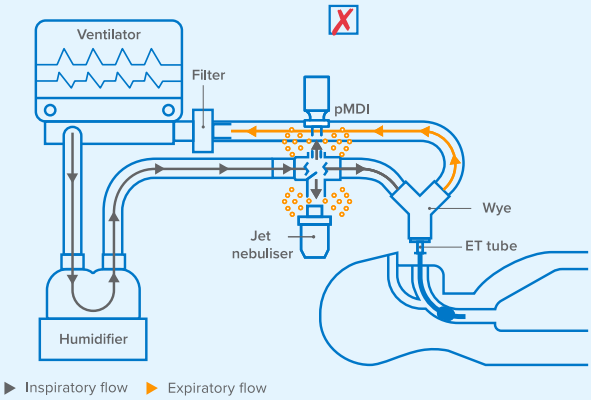
which can help mitigate the release of fugitive aerosols during nebulisation[†2,8-10]

The importance of a closed-circuit system

Clinical and scientific societies around the world recommend the use of closed-circuit nebulisers for the management of patients with COVID-19 requiring aerosol drug delivery.[4,5,11-15]

Interrupted circuit

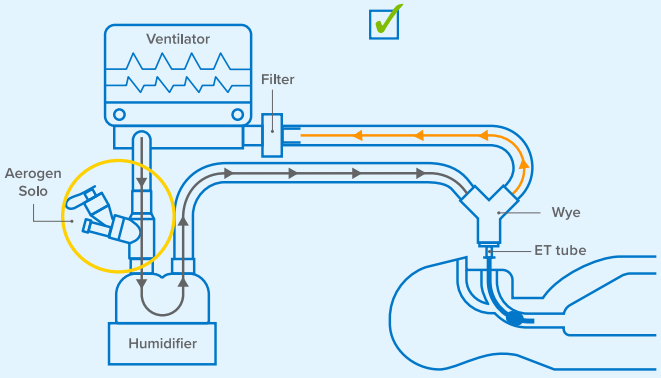
With a pMDI or jet nebuliser, it is necessary to open the respiratory circuit to deliver aerosolised medicine.[16]



Closed-circuit system

As a closed-circuit drug delivery system, Aerogen:

- Maintains a closed ventilation circuit[2,7]
- Eliminates the need to open the circuit when administering medication[2,7]



In studies, the use of Aerogen for aerosol drug delivery was associated with lower fugitive aerosol emissions *versus* jet nebulisers during invasive mechanical ventilation,[‡2] high-flow[§10] and when self-ventilating.[¶8,‖9]

Aerogen addresses many of the challenges associated with aerosol drug delivery in the ICU

Workflow

Equipment required to supply compressed gas for jet nebulisers limits their portability.[17,18]

Using a continuous jet nebuliser in ventilated patients, with the need for added flow, affects tidal volume and FiO_2 (fraction of inspired oxygen) and is not recommended for aerosol delivery in this setting.[1]

With Aerogen

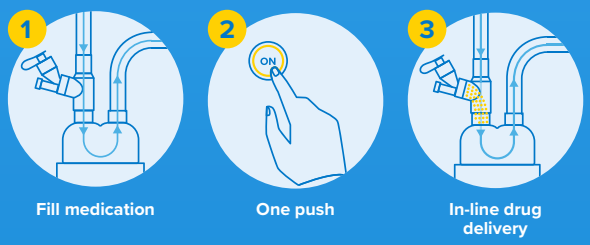
- ✓ In-line aerosol drug delivery[7]
- ✓ Portable[7]
- ✓ No added flow required[7]
- ✓ 28-days intermittent or 7-days continuous use[7]
- ✓ One system throughout a patient's respiratory journey (IMV, NIV, HF, self-ventilating [SV]),[7] supporting continuity of care

Time, training, resources and noise

Time, training and resources are required to follow a pMDI protocol.[17,19,20]

Jet nebulisers generate noise,[21] making it difficult to maintain a calm environment for patients and staff.

Aerogen: quick and easy to set up[7] and virtually silent during use[7,22]



Medication wastage

Jet nebulisers may leave as much as half of the medication unused in the medication cup at the end of a treatment.[23-26]

Incorrect inhaler technique can lead to inconsistent dosing.[17,27,28] As much as 87% of inhaler doses dispensed in hospital may be wasted.[#29]

Aerogen has exceptionally low residual volume *versus* jet nebulisers[7,23]

<0.1 mL
of a 2.5-mL salbutamol dose
Aerogen

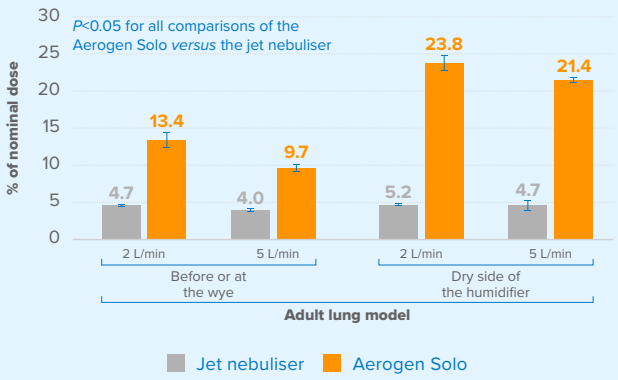
<1.6 mL
of a 2.5-mL salbutamol dose
Jet nebuliser

Aerogen facilitates effective medication delivery across multiple respiratory modalities[30-35]

Invasive mechanical ventilation

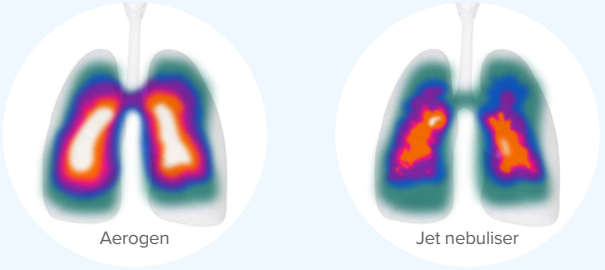
~4x more drug deposition with Aerogen *versus* a jet nebuliser during simulated invasive mechanical ventilation.[††30,‡‡31]

Simulated invasive mechanical ventilation in an adult lung model[31]



Non-invasive ventilation

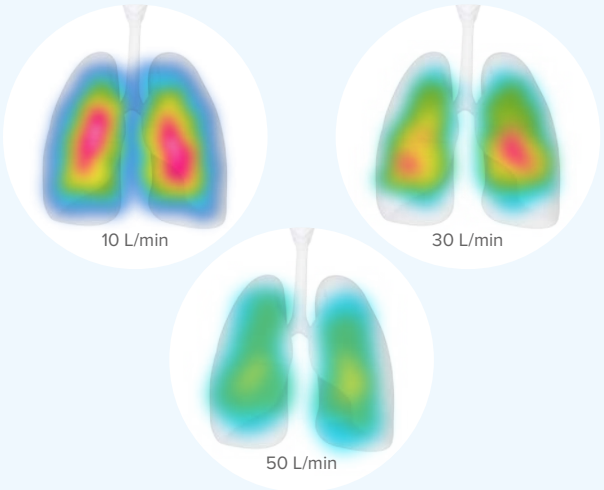
4x more medication delivered to the lungs *versus* a jet nebuliser.[§§32,¶¶36]



Representative scintigraphic images

High-flow therapy

3.5–17% medication delivery to the lungs, depending on flow rates.[§§33]



Representative scintigraphic images

Self-ventilating

6x more drug deposition when self-ventilating *versus* a jet nebuliser.[‖‖34]

Representative scintigraphic images

The AerICU® portfolio from Aerogen

Aerogen® Solo

Aerogen Solo is a vibrating mesh nebuliser intended for physician-prescribed medications for inhalation, which are approved for use with a general-purpose nebuliser.[7]

- Quick and easy to set up[7]
- Virtually silent[7,22]
- Single patient use[7]
- No added flow[7]
- Powered by Aerogen Pro-X Controller[1] or Aerogen USB Controller[38]

Aerogen® Ultra

A handheld device used in conjunction with the Aerogen Solo to deliver inhalation treatment either during exacerbations or post-ventilation.[37]

Aerogen® Pro-X Controller

The Aerogen Pro-X Controller portable power source, with 30-minute and continuous modes, has been developed to facilitate aerosol medication delivery throughout the hospital.[7]

Aerogen® USB Controller

A portable power source that can be operated from the USB connection and USB ports on ventilators and other medical equipment (not available in the US).[38]

Reach out to your Aerogen representative to equip your ventilator fleet with an Aerogen Solo System today!

†Studies by Joyce et al and McGrath et al were performed in in-vitro models of mechanical ventilation and self-ventilation, respectively; studies by Harnois et al and Li et al were self-ventilation and high-flow studies, respectively, performed in healthy subjects. ‡Defined as median (interquartile range) particulate number concentration during simulated drug refill in an in vitro model of invasive mechanical ventilation; between-group difference, 0/cm^{-3} (0.1–1.6) *vs* 710/cm^{-3}(265–1211); *P*=0.032. §Defined as fugitive aerosol concentrations *versus* baseline with Aerogen via Airvo 2 (high-flow) *versus* jet nebuliser with mouthpiece of facemask at particles of 1.0–3.0 µm (all *P*<0.05); study performed in healthy subjects. ¶Defined as mean aerosol concentrations at a distance of 0.8 m and 2.2 m over 30 minutes; in-vitro model of a self-ventilating adult. ‖Defined as fugitive aerosol concentrations with jet nebuliser *vs* Aerogen with a mask at particle sizes of 1.0–5 µm and with a mouthpiece at particle sizes of 0.5–3 µm (all *P*<0.05); study performed in healthy subjects. #A single-centre, retrospective assessment of wasted doses of inhaler use in hospitalised patients with chronic obstructive pulmonary disease or asthma and admitted between January 2011 and June 2012. ††In-vitro model. ‡‡When placed 15 cm from the Y-Piece in a heated setting; in-vitro model. §§Study performed in healthy subjects. ¶¶Study performed in stable subjects with moderate-to-severe COPD. ‖‖Study performed in healthy subjects; between-group difference: 34.1% *vs* 5.2%; *P*<0.001.

1. Li J, Liu K, Lyu S, et al. Ann Intensive Care. 2023;13(1):63. **2.** Joyce M, McGrath JA, Mac Giolla Eain M, et al. Pharmaceutics. 2021;13(2):199. **3.** O'Toole C, Joyce M, McGrath JA, et al. Ann Transl Med. 2021;9(7):592. **4.** Fink JB, Ehrmann S, Li J, et al. J Aerosol Med Pulm Drug Deliv. 2020;33(6):300-304. **5.** Global Initiative for the Diagnosis, Management, and Prevention of Chronic Obstructive Lung Disease: Global strategy for prevention, diagnosis and management of COPD, 2023. Available at: www.goldcopd.org/2023-gold-report-2/. Accessed: July 2024. **6.** Ari A. Respir Med. 2020;167:105987. **7.** 30-354 Rev U Aerogen Solo System Instruction Manual. **8.** McGrath JA, O'Sullivan A, Bennett G, et al. Pharmaceutics. 2019;11(2):75. **9.** Harnois LJ, Alolaiwat AA, Jing G, et al. Respir Care. 2022;67(4):394-403. **10.** Li J, Alolaiwat A, J Harnois L, Fink JB, Dhand R. Respir Care. 2022;67(4):404-414. **11.** American Association for Respiratory Care SARS CoV-2 Guidance Document. Available at https://www.aarc.org/wp-content/uploads/2020/03/guidance-document-SARS-COVID19.pdf. Accessed: July 2024. **12.** Cinesi Gómez C, Peñuelas Rodríguez O, Luján Torné M, et al. Med Intensiva (Engl Ed). 2020;44(7):429-438. **13.** Respiratory care committee of Chinese Thoracic Society. Zhonghua Jie He He Hu Xi Za Zhi. 2020;17(0):E020. **14.** Kumar S, Mehta S, Sarangdhar N, et al. Expert Rev Respir Med. 2021;15(4):519-535. **15.** Swarnakar R, Gupta NM, Halder I, et al. Lung India. 2021;38(Supplement):S86-S91. **16.** Mac Giolla Eain M, et al. Drug Deliv. 2021;28(1):1496-1500. **17.** Gardenhire DS, Nozart L, Hinski S. A Guide to Aerosol Delivery Devices for Respiratory Therapists, 5th Edition.American Association for Respiratory Care, 2023. **18.** Ari A. Eurasian J Pulmonol 2014;16:1-7. **19.** Sanchis J, Gich I, Pedersen S. Chest. 2016;150(2):394-406. **20.** Hatley RH, Parker J, Pritchard JN, et al. J Aerosol Med Pulm Drug Deliv. 2017;30(1):71-79. **21.** Li J, Fink JB. Ann Transl Med. 2021;9(7):590. **22.** Royal National Institute for Deaf People (RNID). How loud is too loud? https://rnid.org.uk/information-and-support/ear-health/protect-your-hearing/how-loud-is-too-loud/. Accessed: July 2024. **23.** Lin HL, Fang TP, Cho HS, et al. Pulm Pharmacol Ther. 2018;48; 225-231. **24.** Sidler-Moix AL, Di Paolo ER, Dolci U, et al. Respir Care. 2015;60(1):38-46. **25.** Ashraf S, McPeck M, Cuccia AD, et al. Respir Care. 2020;65(10):1419-1426. **26.** Saeed H, Mohsen M, Salah Eldin A, et al. Respir Care. 2018;63(11):1370-1378. **27.** Chierici V, Cavalieri L, Piraino A, et al. Expert Opin Drug Deliv. 2020;17(7):1025-1039. **28.** D'Angelo D, Chierici V, Quarta E, et al. Int J Pharm. 2023;631:122478. **29.** Sakaan S, Ulrich D, Luo J, et al. Hosp Pharm 2015;50(5):386-390. **30.** Ari A, Areabi H, Fink JB. Respir Care. 2010;55(7):837-844. **31.** Ari A, Atalay OT, Harwood R, et al. Respir Care. 2010;55(7):845-851. **32.** Galindo-Filho VC, Ramos ME, Rattes CS, et al. Respir Care. 2015;60(9):1238-1246. **33.** Alcoforado L, Ari A, Barcelar JM, et al. Pharmaceutics. 2019;11(7):320. **34.** Dugernier J, Hesse M, Vanbever R, et al. Pharm Res. 2017;34(2):290-300. **35.** Berlinski A, Willis JR. Respir Care. 2013;58(7):1124-1133. **36.** Galindo-Filho VC, Alcoforado L, Rattes C, et al. Respir Med. 2019;153:60-67. **37.** 30-1487 Rev A Aerogen Ultra Instruction Manual. **38.** 30-763 Rev H Aerogen USB Controller System Instruction Manual.

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