A Guide To

Aerosol Delivery Devices for Respiratory Therapists

4th Edition

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With a Foreword by
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DISCLOSURE

Douglas S. Gardenhire, EdD, RRT-NPS, FAARC has served as a consultant for the following companies: Westmed, Inc. and Boehringer Ingelheim.

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Foreward

Aerosol therapy is considered to be one of the cornerstones of respiratory therapy that exemplifies the nuances of both the art and science of 21st century medicine. As respiratory therapists are the only health care providers who receive extensive formal education and who are tested for competency in aerosol therapy, the ability to manage patients with both acute and chronic respiratory disease as the experts in aerosol therapy allows the concept of "art" and "science" to take on a practical reality.

Respiratory therapists continue to be the experts when it comes to the art and science of aerosol therapy. With the rapidly changing field of aerosol medications and delivery systems, it is imperative that we not only share this expertise with patients but also other members of the health care delivery team across the continuum of care. With a renewed focus on wellness and prevention within the U.S. health care system and a determined focus to minimize cost and waste, the choice of appropriate respiratory medications and delivery devices makes selection of both the drug and optimum delivery device even more critical.

How does a therapeutic intervention around for centuries still combine the art with science in the context of aerosol therapy? The "science" component includes many different aspects such as pharmacology, cardiopulmonary anatomy and physiology, physics, and a thorough understanding of the different aerosol delivery technologies on the market today. In order to claim expertise in the science of aerosol therapy and optimize it for patients, the respiratory therapist must have concrete knowledge and understanding of the numerous drug formulations, their mode of action, and an understanding of the respiratory conditions where the drug and delivery is recommended and supported by the scientific evidence.

While the "art" of aerosol delivery is much more abstract than the science, it is as equally important to the appropriate delivery of respiratory medications for optimal outcomes. For aerosol therapy, the interaction between technology and human behavior is where "art" comes into play. There is ample scientific evidence of sub-optimal or ineffective use of aerosols when self-administered in large part due to lack of knowledge about proper technique by patients. All too often, patients do not receive optimum (or sometimes any) benefit from their prescribed metered-dose inhalers, dry-powder inhalers, and nebulizers simply because they are not adequately trained or evaluated on their proper use.

The combination of the right medication and the most optimal delivery device with the patient's cognitive and physical abilities is the critical juncture where science intersects with art. For aerosol therapy to be effective, the appropriate delivery system for the medication must be matched to the patient's ability to use it correctly. The art of aerosol therapy does indeed arise from the science. When these two different, but synergistic components of medicine do not properly align, patient adherence decreases. Medication is wasted. Minimal patient benefit is derived.

Because aerosol therapy is integral to our scope of practice and because we are considered the experts in this area, we have a professional obligation to our patients to continue our learning and competencies in the delivery of aerosolized medicines. Respiratory therapists must take advantage of this opportunity to reinforce their value by updating their knowledge of aerosol delivery systems and combining that knowledge with effective assessment of patients requiring this therapy. Recommending an appropriate delivery system tailored specifically to the patient's abilities is part of that assessment.

This guide will provide you the opportunity to advance your knowledge and expertise in aerosol delivery. Mastery of both the art and science of aerosol delivery can have a profound impact on appropriately matching medications and delivery devices to optimize your patients' clinical outcomes. You will also contribute to more cost-effective use of health care system resources.

The fourth edition of this Aerosol Guide delivers detailed and comprehensive information that, when combined with your dedication and commitment to be the professional experts in this important area, will empower you to provide guidance to your physician, nurse, and pharmacist colleagues — but, most importantly, to your patients.

Timothy R. Myers, MBA, RRT-NPS, FAARC
Chief Business Officer
American Association for Respiratory Care

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Learning Objectives

As you read this book, you will be able to:

1. Identify the terminology used in aerosol medicine.
2. State approximate amount of aerosol deposited in the lower respiratory tract for nebulizers, pressurized metered-dose inhalers (pMDIs), and dry-powder inhalers (DPIs).
3. List advantages and disadvantages of inhalation compared to other routes of drug administration.
4. Identify hazards of aerosol therapy that can impact the patient receiving therapy as well as care providers and bystanders.
5. List advantages and disadvantages of nebulizers for aerosol delivery.
6. Compare the principle of operation of a jet nebulizer, mesh nebulizer, and ultrasonic nebulizer.
7. Describe types of pneumatic jet nebulizer designs and methods that are used to decrease aerosol loss from a jet nebulizer during exhalation.
8. Learn steps for correct use of jet, ultrasonic, and mesh nebulizers.
9. Describe the basic components of a metered-dose inhaler.
10. List advantages and disadvantages of metered-dose inhalers.
11. Compare and contrast performance of pMDIs with HFA and CFC propellants.
12. Discuss factors affecting the pMDI performance and drug delivery.
13. Explain the importance of priming and tracking the number of doses for a metered-dose inhaler.
14. Compare and contrast the design of holding chambers and spacers.
15. Identify factors that affect dose delivery from a holding chamber/spacer.
16. List advantages and disadvantages of dry-powder inhalers.
17. Describe the principle of operation of various commercially available dry-powder inhalers.
18. Identify factors affecting the DPI performance and drug delivery.
19. Explain how you know that each DPI is empty.
20. List the correct steps for use of a nebulizer, metered-dose inhaler, metered-dose inhaler with holding chamber/spacer, and dry-powder inhaler.
21. Describe causes and solutions of problems seen with nebulizers, pMDIs, and DPIs.
22. Discuss criteria to assist clinicians in selecting an aerosol delivery device.
23. Identify special considerations for neonatal and pediatric drug delivery.
24. Explain how to establish an infection control management system in aerosol drug delivery.
25. Describe the proper technique of cleaning aerosol delivery devices.
26. Discuss the importance of occupational health and safety for respiratory therapists.
27. List common problems and errors with each type of inhaler.
28. Describe how to instruct and evaluate patients in the use of inhaler devices.

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