

# Inhalation Therapy in Horses



Mandy L. Cha, BS, BVSc<sup>a</sup>, Lais R.R. Costa, MV, MS, PhD<sup>b,\*</sup>

## KEYWORDS

• Inhalation • Pharmacology • Respiratory • Equine • Nebulizer

## KEY POINTS

- Inhalation therapy in horses can be accomplished with nebulizers or pressured metered dose inhalers.
- Nasal or muzzle masks can be used for delivery of inhalation therapy in horses.
- Inhalation therapy is important in the treatment of inflammatory airway disease in horses.
- Inhaled antimicrobial therapy may be adjunctive to systemic therapy for treatment of pneumonia.

## INTRODUCTION

Inhalation therapy has been practiced in humans since ancient times in many cultures, including Chinese, Indian, Greek, Egyptian, Roman, and Hebrew.<sup>1</sup> In all of these cultures, inhalational therapy was performed using condensation of vapor by steaming liquids and combustion of plants or their derivatives, creating a smoke containing aerosolized droplets and solid particles.<sup>1</sup>

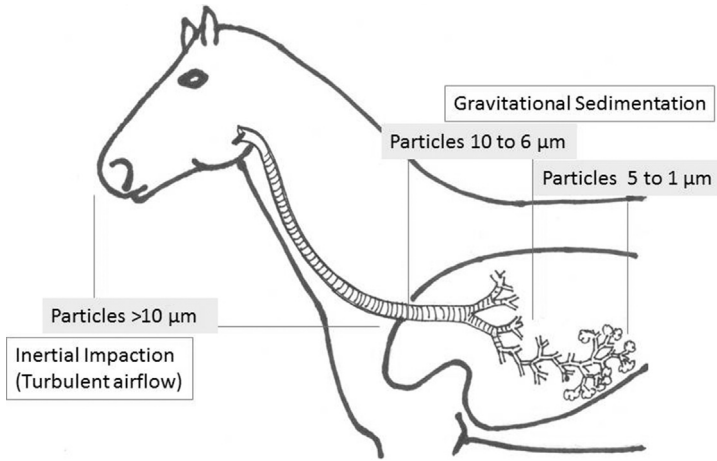
Inhalation therapy is the administration of aerosols into the airway and is a means of delivering topical pulmonary therapy. An aerosol is a suspension of liquid or solid particles dispersed in gas. The physical characteristics of the particles, including size, hydrophobicity, and shape, affect their ability to travel within the airways.<sup>1,2</sup> The size of the particles is regarded as one of the most critical physical characteristics of aerosol therapy. **Fig. 1** depicts a schematic representation of the aerosol deposition throughout the airways of the horse. Large aerosols (>10  $\mu\text{m}$ ) are filtered out in the upper respiratory tract (URT) or deposited in larger airways in association with turbulent airflow and do not effectively reach the lower airways. Midsized particles (10 to 6  $\mu\text{m}$ ) deposit in the larynx, trachea, bronchi, and large-caliber bronchioles. Particles 5  $\mu\text{m}$  or

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<sup>a</sup> Kulshan Veterinary Hospital, 8880 Benson Rd, Lynden, WA 98264, USA; <sup>b</sup> William R. Pritchard Veterinary Medical Teaching Hospital, University of California-Davis, One Shields Avenue, Davis, CA 95616, USA

\* Corresponding author.

E-mail address: [lais.costa65@gmail.com](mailto:lais.costa65@gmail.com)



**Fig. 1.** Particle deposition throughout the airways of the horse. Large aerosols ( $>10\ \mu\text{m}$ ) deposit in the upper respiratory tract and larger airways; midsized aerosols ( $10\ \text{to}\ 6\ \mu\text{m}$ ) deposit in the larynx, trachea, bronchi, and large-caliber bronchioles; aerosols less than  $5\ \mu\text{m}$  are deposited in smaller diameter bronchioles and in alveolar acini by gravitational sedimentation; and very small aerosols ( $<1\ \mu\text{m}$ ) remain in suspension, with part being deposited in alveoli and part exhaled.

less are deposited in smaller diameter bronchioles and in alveolar acini by gravitational sedimentation. Very small particles ( $<1\ \mu\text{m}$ ) tend to remain in suspension, and approximately 50% are deposited in alveoli and 50% are exhaled. Small particles may coalesce to make larger particles, which affects deposition. Hydrophilic particles attract water, promoting their deposition deeper in the tracheobronchial tree. More aerodynamically shaped particles are also deposited deeper within the respiratory tract. Patient factors that influence aerosol particle deposition include the depth of breathing, airway patency and reactivity, bronchospasm, and coughing.

Inhalation medications may be in the form of solutions, powders, vapors, or pressurized cartridges, when solutions or powders are administered with a propellant. The onset of action of aerosolized drugs is relatively rapid; however, the effects are usually short-lived; this is because the aerosolized drugs are partially degraded in the lung, cleared from the respiratory tract by the mucociliary escalator, and absorbed into the blood stream where they are disposed of by breakdown and excretion as are systemic drugs.

#### **ADVANTAGES AND DISADVANTAGES OF INHALATION VERSUS SYSTEMIC ROUTE OF DRUG ADMINISTRATION**

The inhalation route has long been perceived as the best route to affect the components of the airways and alveoli. The blood-bronchial barrier limits the access of systemically administered drugs to the airway lumen and to the cells lining the lower respiratory tract (LRT). In order to achieve drug penetration, high systemic doses are often required.

Some drugs, such as sympathomimetic and parasympatholytic agents used in the management of equine asthma, including recurrent airway obstruction (RAO) and inflammatory airway disease (IAD), may result in undesirable and sometimes life-threatening

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