

Are inhalers with spacers better than nebulizers for children with asthma?

■ EVIDENCE-BASED ANSWER

Metered-dose inhalers with a spacer (MDI/S) are as good as, or better than, nebulizers for children with asthma. This is based on numerous randomized controlled trials that compared outcomes such as hospital admission rates, asthma severity scores, and pulmonary function scores (strength of recommendation: **A**, based on consistent randomized controlled trials and meta-analysis).

■ EVIDENCE SUMMARY

A Cochrane review of 10 randomized controlled trials comparing nebulizers with MDI/S, both in adults and in children aged >2 years, showed a substantial trend towards improvement in hospital admission rates with MDI/S use. Sample size for each study was small, ranging from 18 to 152 patients, with a total sample size of 880 children and 444 adults.

The relative risk of admission for MDI/S vs nebulizer for children was 0.65 (95% confidence interval, 0.4–1.06). Secondary outcomes were equivalent or slightly improved, including duration in the emergency department, changes in respiratory rate, blood gases, pulse, tremor, symptoms score, lung function, and use of steroids. Patients with life-threatening asthma (for example, those considered for ventilation) or other chronic illnesses were excluded.¹

All but 1 of these studies were set in the emergency department and all involved the use of one of a variety of spacers with the MDI, such as the Aerochamber or Inspirease. Whether these efficacy studies can be translated into daily outpatient clinical practice remains

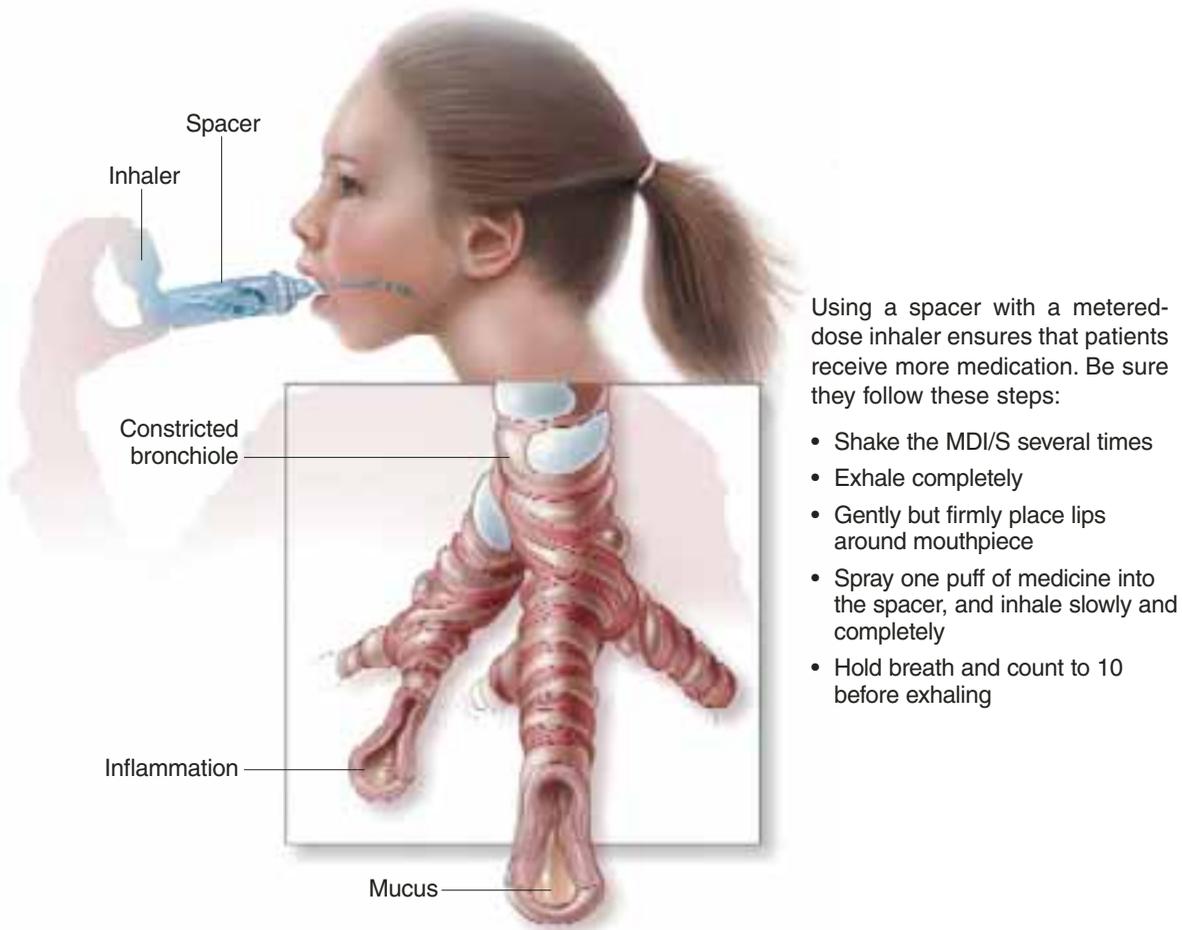
unclear. Emergency departments typically have higher staffing levels, and study subjects and their parents may have received more MDI/S training than is practical in many office settings.

While most of the data were for children aged 2 years and older, 1 study published after the Cochrane review did show a lower admission rate in 85 patients who were 2 to 24 months in the MDI/S group.² Controlling for the initial Pulmonary Index score, children using an MDI and Aerochamber spacer were admitted less often (5% vs 20%, number needed to treat=7; $P=.05$) than children using nebulizers. Since the results of this single small trial are the only data available for this younger age group, using MDI/S instead of nebulizers should be done with caution for children aged <2 years.

Another randomized controlled trial of 152 patients found no difference in primary outcomes of asthma severity score, oxygen saturation, and percent predicted peak expiratory flow rate (PEFR). Several secondary outcomes slightly favored MDI/S: number of treatments given, whether steroids were used, change in heart rate, side effects, rate of hospital admission, and treatment time in the emergency department.³

A smaller double-blinded randomized controlled trial of 33 children aged 6 to 14 years showed no difference in MDI/S vs nebulizer, as measured by clinical score, respiratory rate, oxygen saturation, and forced expiratory volume at 1 second (FEV₁).⁴ The researchers calculated the study had 90% power to detect a clinically meaningful difference in FEV₁ of 12% of the predicted value between the groups.

Other review articles reach the same conclusion. One article reviewed the literature from 1980 to 1996 and examined 17 prospective clinical trials. Outcomes measured included pulmonary function measures and clinical

FIGURE MDI with spacer is beneficial when used properly

ILLUSTRATIONS BY JENNIFER E. FAIRMAN

scores. The researchers recommended that MDI/S be used due to clinical benefit, safety, lower cost, personnel time, and speed and ease of administration.⁵

A review article from the British literature examined 3 randomized controlled trials involving 51 patients and found no superiority of nebulizer vs MDI/S.⁶ A similar review article examined 14 randomized controlled trials for beta-agonist delivery for patients aged 5 to 15 with stable asthma. They found no obvious benefit of 1 type of device over another, including nebulizer, MDI/S, and dry powder inhalers.⁷ These last 2 articles claimed to be systematic reviews, although they do not clearly state their search methodology.

Researchers used a wide variety of spacers in all aforementioned studies; accordingly, one can-

not be recommended as superior to others. The degree of teaching given to parents and children about MDI/S use was not described in any of the trials.

■ RECOMMENDATIONS FROM OTHERS

Guidelines from the Global Health Initiative for Asthma, a collaboration of the National Heart, Lung and Blood Institute and the World Health Organization, recommend MDI/S for children with asthma due to increased efficacy and decreased cost (revised in 2002). Specifically, they recommend a spacer with a face mask for infants and preschool children, a mouthpiece and spacer for children aged 4 to 6 years, and a dry powder inhaler or breath-activated device from age 6 onwards.⁸ Cincinnati Children's Hospital's

evidence-based guidelines from 1998 also recommend MDI/S for children aged >1 year with acute asthma exacerbations.⁹ This guideline suggests using 4 to 8 puffs from a 90 µg albuterol MDI at 1- to 2-minute intervals every 20 minutes for 1 hour, then every 1 to 4 hours subsequently.

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■ CLINICAL COMMENTARY

Use MDIs with spacers in all but the youngest patients

Until recently, using a nebulizer for the wheezing child or infant seemed intuitively to be the most effective way to deliver bronchodilators. However, with recent data showing that MDIs with spacers are just as effective, I have been using MDIs with spacers for all but my youngest patients. Parents as well as physicians may need to be convinced that using less technology in this case is better for their child. In some cases, parental acceptance of therapy necessitates using a nebulizer.

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Do antipyretics prolong febrile illness?

■ EVIDENCE-BASED ANSWER

Antipyretics appear to have minor and variable effects on the course of febrile illness. Aspirin and acetaminophen do not prolong the course of rhinovirus illness, although they may prolong the period of viral shedding and worsen nasal congestion (strength of recommendation [SOR]: **A–**, based on small randomized controlled trials).

Acetaminophen did not affect symptoms, overall condition, or time to complete healing in children with varicella, although it increased the time to total scabbing of lesions (SOR: **A**, based on a small randomized controlled trial). Aspirin and acetaminophen may prolong influenza A illness (SOR: **C**, based on a poor-quality, retrospective observational study).

Acetaminophen may prolong the course of *Shigella sonnei* infection (SOR: **B–**, based on a small retrospective cohort study). It does not affect malaria cure rate, and there are insufficient data to assess clearance of *Plasmodium falciparum* (SOR: **C**, based on small randomized controlled trials with heterogeneous results).

■ EVIDENCE SUMMARY

Acetaminophen has a different mechanism of action from other antipyretics. It halts the production of prostaglandin in the brain but not in

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