

# A metered-dose inhaler with a spacer was more effective than a nebuliser in children with acute asthma

Chou KJ, Cunningham SJ, Crain EF. *Metered-dose inhalers with spacers vs nebulizers for pediatric asthma. Arch Pediatr Adolesc Med. 1995 Feb; 149:201-5.*

## Objective

To determine the effectiveness of a metered-dose inhaler (MDI) with a spacer compared with a nebuliser for the administration of albuterol in children with acute asthma.

## Design

Randomised controlled trial.

## Setting

Inner-city paediatric emergency department (ED) in the United States.

## Patients

152 patients who were  $\geq 2$  years of age (median age, 8 y; 85 boys), had  $\geq 2$  previous episodes of wheezing, and were wheezing at presentation to the ED. Exclusion criteria were history of other chronic illnesses, altered mental status, initial oxygen saturation  $< 90\%$  while

breathing room air and severe asthma according to a validated asthma severity score index, or mechanical ventilation. Follow-up was complete.

## Intervention

Patients were allocated to albuterol by MDI with a spacer, 3 puffs/dose (90  $\mu\text{g}$ /puff) ( $n = 71$ ) or to albuterol, 0.15 mg/kg body weight (maximum 5 mg) in 3 mL of normal saline solution by oxygen-driven nebuliser at a flow rate of 6 L/min ( $n = 81$ ). Children unable to use the mouthpiece were given a spacer with a face mask.

## Main Outcome Measures

Primary outcomes included the percentage change in asthma severity score, percentage of predicted peak expiratory flow rate for children  $> 5$  years, and oxygen saturation. Secondary outcomes were number of treatments given, need for steroids, admission rate, duration of treatment in the ED, percentage change in heart rate, and other side effects associated with  $\beta$ -agonist therapy.

## Main Results

The groups did not differ for any of the primary outcomes or for the secondary outcomes of treatments given, need for steroids, or hospital admissions. Patients in the MDI group, however, spent less mean treatment time in the ED (66 vs. 103 min;  $P < 0.001$ ) and had a smaller mean percentage increase in heart rate (5% vs. 15%;  $P < 0.001$ ) than patients in the nebuliser group. Fewer patients in the MDI group had episodes of vomiting (8% vs. 20%;  $P < 0.001$ ).

## Conclusion

A metered-dose inhaler with a spacer for the administration of albuterol was an effective alternative to a nebuliser in children with acute asthma and resulted in both shorter treatment time spent in the emergency department and fewer side effects.

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## Commentary

Inhaled  $\beta_2$ -agonists are the established first-line therapy for acute episodes of bronchoconstriction in children with asthma. This randomised study by Chou and colleagues addresses the issue of optimal delivery. The results indicate that an MDI with a spacer is a valuable alternative to a nebuliser. The validity of this finding would have been greater if the study had been double-blind. An open design always implies a substantial risk for bias, even on measures such as the effort-dependent peak-flow measurement. The results, however, corroborate the findings of a previous small double-blind crossover trial (1).

Most of the evidence for the efficacy of an MDI with a spacer in treating acute asthma has been obtained from studies of children who had mild or moderate bronchoconstriction, as in the present

study. Therefore, this treatment should primarily be reserved for these patients until further studies are done (2). In patients with severe acute asthma attacks, nebulisers are probably still advantageous, allowing oxygen to be administered at the same time as the  $\beta_2$ -agonist.

Spacers reduce the total dose given to the patient without a concomitant reduction in the deposition of drug in the intrapulmonary airways, resulting in a high therapeutic ratio (clinical effect/systemic ratio) (3). This is advantageous when high drug doses are used. In this study, the nebuliser seemed to cause greater systemic effects than the spacer treatment, possibly because of this phenomenon. However, the greater effects may also have been caused by the different doses used in the 2 inhalers. It cannot be excluded that similar clinical effects

could have been achieved by a lower dose in the nebuliser. The question of equipotent doses among various delivery systems has not been addressed. Drug output may show a 10-fold variation among various nebuliser brands. Therefore, accurate dose comparisons may be difficult.

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## References

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