

Nebulizers Versus Inhalers With Spacers for Acute Asthma in Pediatrics

EBEM Commentators

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SYSTEMATIC REVIEW SOURCE

This is a systematic review abstract, a regular feature of the *Annals'* Evidence-Based Emergency Medicine (EBEM) series. Each features an abstract of a systematic review from the Cochrane Database of Systematic Reviews and a commentary by an emergency physician knowledgeable in the subject area.

The source for this systematic review abstract is: Cates CJ, Bara A, Crilly JA, Rowe BH. Holding chambers versus nebulisers for beta-agonist treatment of acute asthma (Cochrane Review). In: *The Cochrane Library*. Issue 4. Oxford, United Kingdom: Update Software; 2003.

The *Annals'* EBEM editors helped prepare the abstract of this Cochrane systematic review as well as the Evidence-Based Medicine Teaching Points.

OBJECTIVE

To assess the effects of holding chambers compared with nebulizers for the delivery of β_2 -agonists for acute asthma in children.

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DATA SOURCES

An initial search was performed using the Cochrane Airways Group trials register (composed of MEDLINE, EMBASE, CINAHL, and United Kingdom Research Register standardized searches) and other relevant electronic databases. The reviewers searched the bibliographies, contacted trialists, and searched conference proceedings for additional published and unpublished studies. The review is considered updated to November 2002.

STUDY SELECTION

Randomized controlled trials in adults and/or children (≥ 2 years) with acute asthma, where holding chamber β_2 -agonist delivery was compared with wet nebulization. This report will focus on the results from studies of children only.

DATA EXTRACTION AND ANALYSES

Two reviewers independently selected articles for inclusion, evaluated methodological quality of the studies, and abstracted the data. Continuous variables were reported as weighted mean difference, and dichotomous variables were reported as relative risk, both with associated 95% confidence intervals (CIs).

MAIN RESULTS

This review has been updated in 2003 and has now analyzed 1,076 children and 444 adults included in 22 trials from emergency department (ED) and community settings. In addition, 5 trials on inpatients with acute asthma (184 children and 28 adults) have been added to the review. Method of delivery of β_2 -agonist did not appear to affect hospital admission rates. In children, the relative risk of admission for holding chamber versus nebulizer was 0.65 (95% CI 0.4 to 1.06). In addition, length of stay in the ED was significantly shorter when the holding chamber was used, with a weighted mean difference of -0.47 hours (95% CI -0.58 to -0.37 hours). Peak flow and forced expiratory volume were similar for the 2 delivery methods. Pulse rate was lower for the holding chamber in children (weighted mean difference -7.6% baseline; 95% CI -9.9 to -5.3% baseline).

CONCLUSION

Metered-dose inhalers with holding chambers produced outcomes that were at least equivalent to nebulizer delivery. Holding chambers may have some advantages compared with nebulizers for children with acute asthma.

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COMMENTARY: CLINICAL IMPLICATION

Inhaled β_2 -agonists are the drug of first choice for relieving bronchospasm in children. They have traditionally been delivered in the ED by wet nebulization. Recently, metered-dose inhalers with holding chambers (or spacers) have been evaluated because they are potentially less expensive, simpler to use, and more efficient.¹

This Cochrane review suggests that ED treatment with wet nebulization and metered-dose inhaler/spacer are essentially equivalent in children. There was no difference in hospital admissions between the 2 groups. The children treated with metered-dose inhaler/spacer had a shorter length of stay in the ED, less hypoxia, and fewer side effects (eg, lower pulse rates).

Unfortunately, many different dosing intervals and dosages of β_2 -agonist were investigated, making the interpretation of results problematic, and few studies (5 of 19) were double blind, suggesting bias may have influenced the results. The results of this review cannot be generalized to children younger than 2 years, with status asthmaticus, or requiring oxygen, because these groups were excluded from most trials. Since the Cochrane update, a trial in children aged 2 to 24 months found that metered-dose inhaler/spacer was as efficacious as nebulizers for ED treatment of asthma.² Moreover, in patients with severe asthma, this approach resulted in fewer hospital admissions and less tachycardia.

Recent studies have shown that satisfaction with metered-dose inhaler/spacer use in the ED is extremely high and that the majority of children find the metered-dose inhaler/spacer "easy" or "very easy" to use. Most would prefer this method of drug delivery to nebulization.^{1,3} There are no rigorous cost-effectiveness studies comparing the 2 methods in children. One ED study has reported a cost savings for metered-dose inhaler/spacer,

but this was based on a decreased admission rate in that group.¹ Results of an economic analysis will vary depending on many factors including whether spacers are given away or reused, whether respiratory therapist time is required to administer nebulizers, and whether the investigator believes that metered-dose inhaler/spacer use prevents admission or decreases ED length of stay.

Despite the evidence, many hospitals have been slow to adopt metered-dose inhalers/spacers in the ED.^{1,4} Recently, a tertiary care pediatric hospital in Australia published the results of a program used to switch to metered-dose inhaler/spacer in the ED and in the hospital.⁴ They used multidisciplinary input and educational sessions to develop and promote a clinical practice guideline that resulted in 100% physician adherence by the third month. With the change to metered-dose inhaler/spacer, they showed no change in ED length of stay or hospital admission rate.

TAKE HOME MESSAGE

Metered-dose inhalers with spacers perform at least as well as wet nebulization in the delivery of β_2 -agonists to children presenting to the ED with acute asthma. Large, randomized, double-blind, controlled trials are required to determine the optimum delivery intervals and doses of β_2 -agonists delivered by spacer.

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EBEM TEACHING POINT

EMBASE. EMBASE, the electronic version of Excerpta Medica, is considered the European equivalent to MEDLINE. EMBASE contains approximately 8 million references to journal articles and covers approximately 400 journals from 70 countries. This database only references articles from 1974 to the present, with a 15-day lag from the time the journal is received. EMBASE uses a specific thesaurus for indexing called Emtree, and this index did not introduce a specific term for randomized controlled trials until 1994. EMBASE predominately references

English-language articles (90% of current references). This database has a strong European content and moderate overlap with MEDLINE, with only 33% of journals from North America. The EMBASE database places special focus on physical and occupational therapy, biology, drug research, psychiatry, health policy, and alternative medicine. The database is produced in The Netherlands by Elsevier and is available online; however, no free version is available. Evidence suggests that searches confined to MEDLINE miss randomized, controlled trials in therapeutic areas, and the percentage of missed randomized, controlled trials varies with the topic area.⁵ Although for some topics and journals MEDLINE and EMBASE overlap, to per-

form a "complete" search of the literature for a systematic review both of these electronic databases must be used.

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