Review: pressurised metered dose inhalers are as effective as other hand held inhalers for corticosteroid use in asthma


QUESTION: In patients with stable asthma, is the standard chlorofluorocarbon containing pressurised metered dose inhaler (PMDI) as effective as other hand held inhaler devices for delivering corticosteroids?

Data sources
Studies published from 1966 to July 1999 were identified by searching the Cochrane Airways Group trials database (derived from Medline, EMBASE/Excerpta Medica, CINAHL; hand searches of 18 relevant journals and proceedings of 3 respiratory societies; and reviews of bibliographies of relevant studies). Pharmaceutical companies that manufacture inhaled asthma drugs were contacted for unpublished studies.

Study selection
Studies in any language were selected if they were laboratory, hospital, or community based randomised controlled trials of children or adults that lasted ≥ 4 weeks and compared a single drug delivered by a standard PMDI (with or without a spacer) with any other hand held inhaler. Trials comparing different doses of the same drug were also included.

Data extraction
2 reviewers independently extracted data on study design, patient characteristics, details of the intervention, study duration, outcomes, and quality. Outcomes included lung function (FEV₁), quality of life measurements, symptom scores, drugs for additional relief, acute exacerbation, days off work or school, treatment failure, patient compliance, patient preference, adverse effects, bronchial hyperreactivity, and systemic bioavailability.

Main results
24 articles describing 29 studies met the selection criteria. 14 studies compared PMDIs with dry powder inhalers (DPIs): PMDIs were less effective than DPIs for improving FEV₁, morning peak expiratory flow rate, and use of additional relief drugs (table). However, these differences in improvement either disappeared after adjusting for baseline variables or were within clinically equivalent limits. 11 studies compared chlorofluorocarbon PMDI with hydrofluoroalkane (10 studies used beclomethasone, and 1 study used fluticasone). Treatment effects did not differ. 1 study compared breath actuated PMDI with PMDI but found no differences for any outcomes. 3 studies of children were included, but a meta-analysis of the results could not be done because of study differences. None of the studies of children found any differences in pulmonary function between the devices. However, 1 study found that the Turbuhaler group reduced their use of relief drugs by 1 puff per week (95% CI 0.35 to 1.96) more than the PMDI group.

Conclusion
In patients with stable asthma, the standard chlorofluorocarbon containing pressurised metered dose inhaler is as effective as other hand held inhaler devices for delivering corticosteroids.
Review: pressurised metered dose inhalers are as effective as other hand held inhalers for $\beta_2$ agonist bronchodilator use in asthma

Ram FS, Wright J, Brocklebank D, et al, on behalf of the National Health Technology Assessment Inhaler Review Group.

Systematic review of clinical effectiveness of pressurised metered dose inhalers versus other hand held inhaler devices for delivering $\beta_2$ agonist bronchodilators in asthma. BMJ 2001 Oct 20;323:901–5.

QUESTION: In patients with stable asthma, is the standard chlorofluorocarbon containing pressurised metered dose inhaler (PMDI) as effective as other handheld inhaler devices, including chlorofluorocarbon free PMDs, for delivering $\beta_2$ agonist bronchodilators?

Data sources
Studies published from 1966 to December 2000 were identified by searching the Cochrane Airways Group trials database (derived from Medline, EMBASE/Excerpta Medica, CINAHL; handsearches of 20 relevant journals and proceedings of 5 respiratory societies; and review of the bibliographies of included trials), Medline, EMBASE/Excerpta Medica, CINAHL, and 17 online respiratory websites were also independently searched, and pharmaceutical companies that manufacture inhaled asthma drugs were contacted for unpublished studies.

Study selection
Studies in any language were selected if they were laboratory, hospital, or community based randomised controlled trials of children or adults that compared delivery of $\beta_2$ agonist bronchodilators by standard PMDI (with or without a spacer) with any other hand held inhaler. Trials comparing different doses of inhaled drug and those that used challenge testing were also included.

Data extraction
2 reviewers independently extracted data on study design, patient characteristics, details of the intervention, study duration, outcomes, and quality. Outcomes included lung function (FEV1), quality of life measures, symptom scores, drugs for additional relief, steroid requirements, nocturnal awakening, acute exacerbations, days off work or school, treatment failures, patient compliance, patient preferences, adverse effects, bronchial hyperreactivity, and systemic bioavailability.

Main results
89 articles describing 84 studies met the selection criteria. 71 trials involved adults and 13 involved children. In most trials, patients had mild to moderate asthma (baseline FEV1 > 50% of predicted). Meta-analyses were done using a fixed effects model. In both adults and children, standard PMDs did not differ from any of the other 10 hand held inhaler devices (Turbohaler, Diskhaler, hydrofluoroalkane PMDI, Rotahaler, Spirios, Easyhaler, multidose powder inhaler, Clickhaler, Gentlehaler, and Autohaler) for FEV1, forced vital capacity, peak expiratory flow rate, area under the curve for FEV1, blood pressure, symptoms, bronchial hyperreactivity, systemic bioavailability, inhaled steroid requirement, serum potassium concentration, or use of additional relief bronchodilators. However, regular use of the hydrofluoroalkane PMDI containing salbutamol was associated with reduced requirement for short courses of oral corticosteroids (relative risk 0.67, 95% CI 0.49 to 0.91).

Conclusion
In patients with stable asthma, the standard chlorofluorocarbon containing pressurised metered dose inhaler (PMDI) is as effective as other hand inhalers, including chlorofluorocarbon free PMDs, for delivering $\beta_2$ agonist bronchodilators.

COMMENTARY—continued from previous page

The amount of aerosol delivered to the lungs is determined by aerosol particle size, velocity, and inspiratory flow rate. In the hydrofluoroalkane PMDs, the drug is reformulated as a solution. This approach increases the fine particle fraction, which results in increased drug delivery to the lung and decreased oropharyngeal deposition. Hydrofluoroalkane PMDs are portable, convenient, and contain no chlorofluorocarbon propellants.

DPI systems are a portable, propellant free, breath actuated alternative to PMDs that help overcome breath to hand coordination difficulties. Many have dose counters that allow patients and physicians to monitor treatment. However, in outpatient settings, delivery that requires loading may be inconvenient and may result in decreased adherence to treatment. The efficiency of drug delivery with DPIs also varies according to a patient’s inspiratory flow rate.

With all hand held delivery systems, drug delivery and efficacy are affected by such patient factors as coordination, inspiratory flow rate, and technique. As clinicians, our primary goal is to enhance compliance with treatment for optimal drug delivery while keeping overall costs low. To maximise treatment success, the choice of a delivery system must take into account patient preference, ability, lifestyle, and disease severity. Cost effectiveness will be maximised with a delivery device that is tailored to a patient’s needs and abilities because reduced adherence may result from lack of perceived efficacy.

These 2 reviews provide evidence that, in an ideal setting, PMDs can be as effective as newer technologies developed to overcome pitfalls in patient technique and compliance.

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