



CLINICAL PRACTICE

Incorrect use of a homemade spacer for treatment of recurrent wheezing in children – a cause for concern

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Inhaled bronchodilators, particularly β_2 -agonists, are one of the most effective therapies for rapid reversal of airway narrowing in acute asthma. In children bronchodilators are best given using a metered dose inhaler (MDI) with attached spacer; this is as effective as nebulised therapy, with fewer side-effects.^{1,2} However, a spacer must be used with a MDI as children are unable to synchronise inspiration with actuation of the MDI nor can they breath hold at the end of inspiration, particularly when there is lower airways obstruction as occurs during an acute asthma attack.^{1,2} A modified 500 ml plastic bottle spacer has been found to be as effective as a conventional small-volume spacer for delivery of bronchodilators in children with acute wheezing.^{3,5} In contrast, a cup has been shown to be a very poor spacer, with poor efficacy when used for giving bronchodilators in the treatment of acute asthma.^{3,5}

The Department of Health has recently begun to institute the World Health Organization (WHO) programme of Integrated Management of Childhood Illness (IMCI) nationally,⁶ to promote timely diagnosis and treatment of the major illnesses in children under 5 years of age. Such an approach has great potential to improve child health and substantially reduce under-5 morbidity and mortality. The South African adaptation of these guidelines recommends use of inhaled β_2 -agonists via MDI bottle-spacer and oral steroids in managing children with recurrent wheezing; these recommendations do not currently form part of the WHO IMCI core programme.⁶ However, we note with concern the method of making and using a bottle spacer advocated to health care providers. The guideline states that to make a spacer from a 500 ml plastic cold-drink bottle one should 'hold the top opening [of the bottle] in very hot

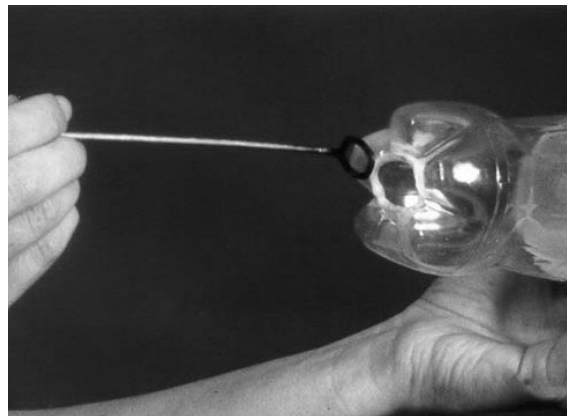


Fig. 1. Adaptation of a 500 ml plastic bottle as a spacer – a wire mould is used to melt a hole in the base to fit the opening of the MDI.

water to make it soft. Push the MDI into it ... Then cut off the bottom of the bottle with a sharp knife. Put tape over this cut edge to avoid hurting the child. Place this end over the face like a mask. When the child breathes spray 5 puffs into the bottle.⁶

These directions are incorrect and quite different from the recommended way of adapting and using a 500 ml bottle as a spacer. In our studies establishing the efficacy of such a spacer, great care was taken to adapt and use the bottle in a specific way as has been described previously.⁷ The following points are of particular importance.

1. A hole should be made in the base of the bottle through which the MDI can be inserted (Fig. 1). As the plastic base is difficult to cut, a hole is melted by applying a heated mould of steel wire (similar in shape and size to the end of the MDI) to the base.⁷ The MDI actuator is inserted after removal of the mould, so as to create a tight fit. Cutting a plastic bottle is extremely difficult. Studies have shown that the best method of creating a hole is to use heat to melt an opening similar in shape to the MDI canister. In addition, cutting the bottle may create sharp, jagged edges which may hurt the child even when covered with tape. Cutting and taping a bottle, as recommended in the IMCI guidelines, simulates a cup, which has been shown to be a very ineffective spacer for delivery of bronchodilators in children.^{3,8,9}

2. The neck of the bottle must be held in the mouth, simulating a mouthpiece in children older than 3 years of age

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Fig. 2. Correct use of a modified 500 ml plastic cold-drink bottle as a spacer. The neck of a bottle is held in the mouth while an MDI is fitted tightly into a hole in the base of the bottle.

(Fig. 2). In younger children, a small well-fitting facemask can be attached to the neck of a modified bottle to enable use in those who are too young to use a mouthpiece. This ensures that a substantial amount of aerosol is not lost to the environment but rather delivered to the airways. The neck of the bottle should not be deformed to try and fit the MDI canister as recommended in the guidelines.

3. A firm seal between the child's mouth and the mouthpiece of the spacer must be made to minimise aerosol leakage; if an attached face mask is used this should fit tightly on the face over the child's nose and mouth. The way in which the guidelines recommend cutting the bottle and placing tape around the edges would result in substantial aerosol leakage around the face, with little delivery to the lungs.^{8,9}

4. Only 1 puff should be fired into the spacer at a time. As has been shown, multiple actuations of the MDI decrease the amount of drug available, therefore drug delivery should be optimised by actuating the canister every few breaths until the desired dose of medication has been given.¹⁰ Therefore 5 puffs should not be given at once, rather 1 or 2 puffs should be given every 10 seconds.

5. The MDI canister should be shaken before use. If the canister is not shaken first no active drug may be delivered to the child, only carrier. There is no instruction in the IMCI guidelines indicating that the canister should be shaken before use.

Although a homemade bottle spacer seems simple to make and use, this is potentially deceptive. Patients, caregivers and health care professionals must be educated as to the optimal

way in which an MDI spacer should be made and used. Studies^{3,8,9} have demonstrated the efficacy of a 500 ml bottle when adapted and used in the correct way. A 500 ml plastic cold-drink bottle (modified as per published recommendations⁷) and conventional spacer have been shown to produce equivalent aerosol deposition in the lungs;^{8,9} however, pulmonary deposition obtained with a cup was found to be only approximately one-fifth of that achieved using a conventional spacer.⁸ Furthermore, clinical studies^{3,5} of children with acute asthma confirm the utility of the 500 ml cold-drink bottle and the poor efficacy of the cup as a spacer, especially in patients with moderate or severe airway obstruction. The poor efficacy of a cup is most likely due to loss of aerosol around the edges of the cup where it fits onto the face.^{8,9} Use of a bottle as recommended in the South African IMCI guidelines, with the bottom cut off to act as a facemask, simulates a cup and would result in substantial loss of aerosol around the face, with little or no drug delivered to the lower airways. This would be a completely ineffective way of administering bronchodilators.

The current recommendations for delivery of bronchodilators as contained in the South African IMCI guidelines⁶ are dangerous and to be discouraged. If we are to use a homemade spacer then we should recommend modification and use of a 500 ml bottle, as has been demonstrated to work effectively in carefully conducted and published trials.^{3,5,8,9} It is ironic that such recommendations should be included in international guidelines, but not in the current IMCI South African guidelines, despite a large amount of research on homemade spacers having been done in South Africa.

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