

More than one million children in the UK have asthma. Those who use spacers with their inhalers have a better chance of getting an effective drug dose

SPACER DEVICES: PART 1 OF 2

Inhaler spacer devices to treat asthma in children

In this article...

- › The prevalence and treatment of asthma
- › A discussion of the evidence for using spacers
- › Correct technique for using spacers

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Abstract: Watson P (2012) Spacer devices 1: inhaler spacer devices to treat asthma in children. *Nursing Times*; 108; 46: 18-20. Drawing on literature searches and professional experience, this article discusses the treatment of asthma with pressurised metered dose inhalers (pMDIs). It demonstrates the need for pMDIs, and presents the health and cost benefits of using a pMDI through a spacer device. Through the review and evaluation of studies, it demonstrates the importance of correct asthma management and the use of spacers. Although there are many types of spacer, and patients often have less than optimal technique, there is evidence to support the overall benefits of use against non-use.

Inhalation is the preferred route of administration for anti-asthma therapies, providing the drug in a form that can reach the smallest airways. Very small doses of active drugs can be delivered to the desired site of action using pressurised metered dose inhalers (pMDIs). As the dose required is smaller than when given by mouth, the side-effects are reduced (Lavorini et al, 2006; National Institute for Health and Clinical Excellence, 2000). Compared with a 4mg tablet of salbutamol, a single dose of

inhaled medication contains 40 times less medication yet delivers the same benefits, when taken correctly (Watt et al, 2003).

Unfortunately, poor inhaler technique frequently leads to reduced drug delivery. In a study of 55 moderate to severely asthmatic children, Watt et al (2003) found only 73% had a technique that would allow any drug delivery.

The scale of the problem

According to Asthma UK (2012a) more than one million children in the UK have asthma. The condition is the most frequent reason for absence from school, accounting for one third of all days missed (Krenitsky-Korn, 2011).

There were 1,131 deaths from asthma in the UK in 2009 (12 of which were in children aged 14 years or under); as many as 90% of deaths from asthma are preventable and an estimated 75% of hospital admissions for asthma are avoidable (Asthma UK, 2012a).

What is asthma?

Asthma is a chronic inflammatory disease of the airways and, in children, is more common in boys than girls (Clinical Knowledge Summaries, 2012).

Many children who develop asthma at a very young age “grow out” of the condition. During the teenage years, the symptoms will disappear in approximately three quarters of all children with asthma (CKS, 2012). If symptoms are moderate to severe during childhood, it is more likely that the condition will return later in life (CKS, 2012).

The cause of asthma is still not fully

5 key points

- 1** One dose of inhaled medication contains 40 times less medication than a 4mg tablet of salbutamol, yet delivers the same benefits, when taken properly
- 2** At least 50% of pMDI users have less than optimal technique and could benefit from using a spacer
- 3** Younger children or those with poor dexterity are often unable to coordinate inhalation with activation of a pMDI and benefit from using a spacer
- 4** Spacers should be cleaned regularly to avoid contamination with pathogens such as *Pseudomonas*, *Klebsiella* and *Staphylococcus*
- 5** Correct inhaler technique could reduce hospital admissions making considerable savings for the NHS



Spacer devices hold medication in a chamber while the child takes normal breaths

understood, but it is thought that a combination of genetic and environmental factors may be involved. The severity of the symptoms varies from child to child and over time, from mild to severe, with the narrowing of the airways usually being reversible – occurring naturally, or in response to medication (CKS, 2012). At present, asthma is not curable, but it can be controlled so that attacks can be prevented.

Treatment

Treatment for children should be a prescribed inhaler, possibly in the form of a pMDI. Often the child will have a preventer (a pMDI used regularly to prevent symptoms from occurring) and a reliever (a pMDI used when necessary to reduce the symptoms of an exacerbation). Unfortunately, younger children or those with poor dexterity are often unable to

coordinate inhalation with activation of the inhaler, which limits the amount of drug inhaled (Watson 2010; Delgado et al, 2007; Russell and Reynolds, 1997).

It is estimated that at least 50% of pMDI users have suboptimal technique and could benefit from using a spacer device (Pearce, 2011; Lavorini et al, 2006). The most detrimental errors are: poor coordination between pMDI actuation and inhalation; and the “cold freon” effect, which may cause some children to stop inhaling when the cold blast of propellant strikes the back of the throat. This greatly reduces drug take-up (Lavorini et al, 2006).

The introduction of spacer devices has helped to overcome these issues.

The role of spacers

Spacers are large plastic or metal containers, with a mouthpiece or mask at one

end and a hole for the aerosol inhaler at the other. Modern devices are convenient and compact and work at least as well as nebulisers in treating most asthma exacerbations in children and adults (Delgado et al, 2007; Dewar et al, 1999; Parkin et al, 1995).

The devices allow the medication to be held in a chamber so the users can receive inhaled medication while taking normal breaths through the mouthpiece. However, poor technique frequently leads to reduced drug delivery (Schultz et al, 2012; Pearce, 2011; Watt et al, 2003; Hindle and Chrystyn 1994).

Keeley (1993) states that compared with dry powder inhalers and pMDIs alone, a pMDI with a spacer device deposits at least 30% more drug in the lungs. Lavorini et al (2006) also documented the benefits of spacers and attributed these to the fact that the user is inhaling from a static volume without necessarily having to coordinate the two actions of breathing and actuation. They concluded that by acting as an aerosol reservoir, the spacer slows the aerosol velocity and increases transit time and distance between the pMDI and the user’s mouth, therefore allowing the particle size to decrease. A result of this smaller particle size is better deposition of the drug in the lungs.

The British Thoracic Society and Scottish Intercollegiate Guidelines Network (BTS/SIGN, 2012) recommend that asthma is managed in children aged 0-5 years by use of a pMDI and a spacer device for the delivery of inhaled steroids.

It is also believed that the correct use of a portable spacer could reduce emergency admissions to hospitals, potentially saving the NHS up to £11.5m per year (Health Enterprise East, 2009).

The technique for using a spacer is outlined in Box 1 and key points for health professionals when teaching parents and children are outlined in Box 2.

Although spacers play an important role in helping to deliver asthma medicine to the lungs, their use is not without some risks. When Cohen et al (2012) tested 30 spacers on children, all 30 were contaminated with pathogens including *Pseudomonas*, *Klebsiella* and *Staphylococcus*; four of these patients later contracted pneumonia. After the authors showed the children how to clean the spacers and masks, the incidence of contamination fell to zero (Cohen et al, 2012).

Reducing static

Static electricity accumulates on many polycarbonate and plastic spacers,

BOX 1. INSTRUCTIONS FOR CHILDREN AND PARENTS ON USING A SPACER DEVICE

- A health professional should show children and parents how to use their inhalers and spacers and check their technique regularly
- Check the spacer fits the inhaler
- Put one puff of the inhaler into the spacer and breathe in deeply through the mouthpiece
- The child should hold their breath for 10 seconds (or for as long as is comfortable) then breathe out slowly
- It is best to take at least two deeply held breaths for each puff of the inhaler
- Children who find it difficult to take deep breaths can breathe in and out of the mouthpiece several times
- The steps above should be repeated for each dose/puff needed
- Wash the spacer once a month – leave it to drip-dry
- Using metal or anti-static spacers can help to ensure that most of the medicine gets into the lungs
- Spacers should be replaced at least every year, especially if used daily

Source: adapted from Asthma UK (2012b)

BOX 2. KEY POINTS FOR SPACER TECHNIQUE

- Too long a delay in inhalation after pMDI actuation may lead to excessive loss of the respirable dose within the spacer device (Lavorini et al, 2006; O'Callaghan and Barry, 2000b)
- If a health professional is actuating the inhaler for a child, this should be done when the child is ready and the spacer in place, as a time delay between actuation and inhalation can result in a reduced intake of medication (O'Callaghan and Barry, 1997)
- Discharging of multiple doses into the spacer at the same time can result in a lower inhalation of medication due to the turbulence in the spacer, leading to a coalescence of small particles into larger particles and excessive deposition on to the spacer walls, often reducing the respirable dose per actuation (Lavorini et al, 2006; Hindle and Chrystyn, 1994)

especially when handled by patients. This attracts drug particles, which become charged when they are produced by the pMDI, resulting in the particles adhering to the spacer walls.

A simple way to reduce the charge on a spacer is to wash it, allowing it to air dry to avoid build-up of static with a drying cloth (Lavorini et al, 2006). Static charge of polycarbonate spacers will vary greatly depending on the washing procedure used, and the use of a non-electrostatic spacer can overcome this problem, although these are not widely available in the UK (O'Callaghan and Barry, 2000b).

Conclusions

It has long been recognised that a pMDI with a spacer device is the best way to deliver bronchodilator therapy for the treatment of asthma (O'Callaghan and Barry, 2000a; Dewar et al, 1999; Zar et al, 1999).

Many studies demonstrate that, when correctly used, spacers are as good as, if not better than, nebulisers at treating asthma (Delgado et al, 2007; Dewar et al, 1999; Zar et al, 1999; Parkin et al 1995), and pMDIs with spacers may be as efficacious as nebulisers for the emergency treatment of asthma symptoms in children.

The use of a pMDI on its own will rarely deliver the optimal treatment to a child. Studies have shown that a spacer will reduce the amount of drug deposited in the oropharynx, while improving the lung deposition of the inhaled drug. The correct use of a portable spacer could reduce emergency admissions to hospitals, potentially saving the NHS up to £11.5m per year (Health Enterprise East, 2009). **NT**

● Next week, in part 2 of this series, Paul Watson describes the development of a new type of spacer

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