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Aerosol therapy in asthma

It is clear that inhaled therapy has greater benefits to oral therapy in asthma; medication has a more rapid onset of action and a maximal therapeutic effect can be obtained with a reduction of likely systemic side effects. Although aerosol therapy has been used in medicine for many years, we still have only a basic understanding of the pharmacokinetics and mechanisms of drug delivery, pattern of drug deposition within the airways, knowledge of drug behaviour at the epithelial level and appropriate drug dosages, especially for children.

There are disadvantages to aerosol therapy, which are compounded in children. Current devices are not easy to use effectively and there is a great intra and inter-subject variability in doses delivered to the lungs. Many studies have demonstrated that patients and doctors, nurses as well as pharmacists cannot use devices properly.

The purpose of this review is to focus on the two main available methods of aerosol delivery; the nebuliser and the combination of a pressurised metered dose inhaler (pMDI) and holding chamber (spacer). Dry powder devices will also be discussed.

Inhalation therapy in children

The issues that need to be addressed are:

- 1) Is the device suitable for that age group?
Will the individual be able to use the device and will the device reliably deliver the drug to the lungs?
- 2) Will the device be tolerated by the subject or in older children do they like the device? Older children who do not like the device will not use it.
- 3) Is the device drug combination likely to minimise systemic effects for a given clinical benefit? The choice of drug can influence the range of possible delivery systems.

What effects drug delivery in children?

Age and technique In younger children and infants, nebulisers with face mask or spacers with face mask are the two main options. From two and half years old children can be instructed to breath in and out through a valved spacer. From aged five to six children can use dry powder inhalers and pMDI with spacers quite effectively. It is unlikely that any child can use pMDI alone, indeed there are many studies highlighting the inability of adults with this method.

Crying and mask fit It is important to appreciate that a close fitting mask is required to achieve adequate inhalation. The child should ideally not be struggling or crying. Having a face mask even a short distance away from the face or treating a screaming child will result in a great reduction of drug delivered to the lungs. This is true for both nebulisers and spacers/pMDI and masks.

Child position If a large volume spacer is used with an attached mask for an infant it is important to have the child lying down horizontally to allow the valve to remain open. If it is used with the child sitting up there will not be adequate flow to move the valve.

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CENTRE FOR COMMUNITY CHILD HEALTH, ROYAL CHILDREN'S HOSPITAL, MELBOURNE



Static A new spacer device carries a high electrostatic charge, which attracts particles to the side of the spacer and can reduce the output of the spacer by up to 64%. It is important that when a spacer is washed, it is washed in water and detergent and then allowed to drip dry without being cleaned with a cloth. This reduces the amount of static within the spacer.

Spacing of dosages Single actuation (metered dose) into the spacer for each dose to be given is ideal. The more actuations put into the spacer at one time, the smaller the proportion of that total dose will be delivered to the patient's lungs. Loading a device with two actuations will reduce the total output by 22%; if five actuations are used there is a 62% reduction. Particles clump and there will be a reduction in number of drug particles in the respirable range.

Timing of inhalation and pMDI actuation It is important that inspiration through the spacer occurs as soon after actuation as possible. The longer the duration before breathing in, the less drug will be deposited in the lung.

Current recommendations

Infants and toddlers (0-5)

The wheezy infant is problematic - some may simply not respond to anti asthma treatment as they do not have asthma / bronchospasm. If it is deemed the infant/toddler has asthma these are suggestions:

pMDI and spacers. These are convenient and capable of delivering effective quantities of drugs to the lungs. There are a number of small volume spacers with valves which can operate at small flows.

Jet nebulisers. Some infants and toddlers will simply not tolerate spacers; jet nebulisers may be the only alternative.

Pre-school children

pMDI and spacers. From 2-3 years children will be capable of using a spacer and pMDI with tidal breathing.

Children over 5 years

pMDI and spacers. These remain the best option for prophylactic therapy, but a more portable system is needed for bronchodilator therapy.

Dry powder systems.

The principle advantage of these devices is that they do not need co-ordination between actuation and

inhalation. The main disadvantage is that the energy required to disperse the dry powder particles is generated by the child's inspiratory effort.

Spacers and acute asthma

There is now good evidence in children that spacers and pMDIs are as effective at treating acute exacerbations as nebulisers. Only very severe asthma is excluded from this as there are no data on the use of spacers in life threatening asthma. There are advantages for the use of spacers in acute asthma in children; it may take a shorter time to administer and children may spend less time in the emergency department and there may be less in the way of side effects (vomiting and increase in heart rate). Spacers are also cheaper and more portable. More importantly advising the use of spacers re-inforces the use of spacers at home and the use of spacers for asthma self-management plans. Children's hospitals in Melbourne and Sydney have started using spacers for treatment of acute asthma and the process of the change is currently under evaluation.

Conclusion

Optimising aerosolised drug delivery in children involves consideration not only of the drugs but more importantly the age and abilities of the child. Devices must be selected to suit a particular child's needs and abilities. Devices utilising tidal breathing are generally used such as spacing chambers or, less commonly these days, nebulisers. A screaming or struggling child, or failure to use a closely fitting mask, reduces drug delivery to the lungs enormously. Failure to respond to inhaled therapy in early childhood may be attributable to failure of drug delivery.

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Separation: the young child and their family

Separation is a life long process: We are born dependent and can spend our lives attempting to deny the reality of our needs for relationships and our own interdependence. One of the major tasks of parenthood is to foster the development of a safely attached child with a secure base. The child who is securely attached is the one who paradoxically is able to safely and creatively separate with minimal anxiety.

Our understanding of babies has been transformed by much new knowledge about the marvellous and subtle skills of the infant and young child in being able to read and respond to social cues. Right from the beginning of life they can perceive much about people, skilfully interpreting their multiple sensory experiences using vision, hearing, smell, touch and taste. Sophistication in these perceptual abilities has allowed the young human to know her caregivers very well. This has been a necessity of survival. John Bowlby articulated Attachment Theory to explain the nature of the baby's bond with his parents and the consequences of disruption of these bonds. Children show discrete patterns of response to the disruption of attachment to their caregivers. Their behaviour upon reunion gives an indication of possible later emotional or relationship vulnerability. Separation anxiety is a common experience, but it can be so pervasive as to interfere with healthy psychophysiological development.

Bowlby in his pioneering work eloquently described the young child's response to loss of close caregivers. Three main phases are described as the child moves from **protest**, a healthy response to try to retain engagement with the caregiver, to **despair** as the child becomes clearly sad and despondent. Should the loss of the loved one be further prolonged, the child may move into a phase of **detachment** and seems to withdraw from contact with those around.

The child's separation from his caregivers can occur in a number of different contexts, ranging from brief periods at home with a friendly babysitter to prolonged periods in hospital or in child care. More dramatic separation can occur with the break up of the parental couple or the death of a parent.

There are many factors which determine the young child's capacity to cope in a healthy way with such separation. Research suggests that a healthy and loving relationship with the child and her caregivers before separation is the best predictor of a good outcome for the child.

In a large American study of infants entering child care undertaken by Jay Belsky and his colleagues, it was notable how resilient young children can be when the

relationships they have at home are secure and sensitive. Children experiencing both poor quality childcare and the least sensitive and responsive relationship with their mothers seemed more vulnerable to difficulties in the long term.

Children can respond to even ordinary experiences of separation with a range of distressing symptoms. Anxiety and worry, clinging behaviour, difficulties with sleep, nightmares and a number of somatic symptoms such as stomachaches, headaches, nausea and even vomiting can occur, as well as developmental regressions and the loss of previously acquired control of the bowel, reduced appetite and aggressive behaviour.

We know a considerable amount about the way children respond, but we know less about the emotional experience of parents when their child must separate from them. Some parents experience intense pain and anxiety when placing their children into day care at an early age. We all know the scenes at the beginning of the school year as parents of children beginning school commiserate with each other at the school gate. It is important to offer an opportunity for parents to discuss their ambivalent feelings without feeling more sad or guilty.

What can we do to minimise the ill effects of separation of children from their parents?

- Where possible prepare the parent for the child's own experiences and response;
- Parents may feel hurt or let down by their child's reaction as he becomes angry, withdrawn or disorganised. Help them anticipate this and not take it personally.
- There may be some regression in the child's developmental achievements: allow for the extra demands the child may place on the family as a consequence.
- Allow space and time for parents to discuss their feelings. Feelings of sadness, anger, guilt and helplessness can be shared with partner or a listening professional. Acknowledge the positive consequences of the freedom that follows for both parent and child. Parents may need to discuss their own experiences of separation or loss, which may be painfully reactivated.
- Parents can explain to the child what is going on - even to a young baby, who listens intently to the mother's expressed affect.
- Upon reunion parents can talk with the child about his/her day's experience and allow for play to develop around themes of separation, feelings of

anger or longing. A hand over discussion with the child's primary carer again demonstrates that the adults have her in mind.

- Gradually increase the time the child spends in the new situation.
- Make the new setting as familiar as possible, bringing some small toys or allowing the child his own well labelled transitional object or comforter. These can provide alive links back to the absent parents.
- Encourage the parents to get to know the child care centre and carers so that the parents can hand their infant to somebody the baby knows and trusts. A safe secure relationship should be built with one of or more of the alternative carers.

Separation on admission to hospital presents additional problems since the child may additionally experience painful procedures. Current practices involve much more direct contact of the parents with the child in hospital, with careful and sensitive explanation about

what will happen. Play specialists may be available to help the child. Avoid making the child feel guilty for his own, at times, disruptive reaction to hospitalisation and separation.

Parenthood and infancy are marvellous times. The hallmark of the human condition is the development of secure and sustained attachment relationships. Paradoxically this also means a life long process of creatively adapting to separations. Professionals have a great deal to offer parents and infants in helping them make the most of this difficult but fulfilling process.

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O F F T H E S H E L F

R is for Reflux A parents guide to infant reflux

Author : Jennie Croudson Blaise Publishing 1998, pp. 90 Price \$19.50 plus \$4.00 postage and handling

With up to 50% of babies under three months of age affected by gastro oesophageal reflux, it is surprising that there is an apparent lack of reading material. An distressed infant with gastro oesophageal reflux can cause significant stress and anxiety for parents.

The book *R is for Reflux* is a simple and straight forward informative guide for parents with a reflux infant as well as for the grandparents, other family members and caregivers.

The text is set out in an easy to understand format covering reflux and its symptoms, diagnosis, anti-reflux treatments, feeding, alternative treatments, where to find help and home management.

The methods of feeding have been dealt with sensitively, recognizing that each baby is an individual. The sensible advice includes frequent reminders to seek professional help when necessary.

Unfortunately the contacts for support are limited mostly to New South Wales. A VISA group is listed for Queensland and New South Wales plus a contact in Western Australia but the Distressed Infants Support Association (DISA) of Victoria needs to be included as a valuable support group.

I am sure parents of a baby with reflux will find this book a valuable resource.

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Books are available from the Child Health Information Centre, a specialist bookshop, information and referral centre for health professionals, parents, teachers and adolescents.

A booklist is available for mail orders or phone orders by credit card can be taken between 9 and 4.30 weekdays on (03) 9345 6429.

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