were diabetic during the pregnancy than if the mothers developed diabetes later in life.³ Thus intrauterine factors can result in a preponderance of affected mothers over fathers without implicating mendelian mechanisms. In the present study, data are not available on the diabetic state of mothers at the time of pregnancy. A long term prospective population study would be required to obtain these data with certainty, following up the offspring for the development of diabetes. Such studies are more readily performed in populations, such as the Pima Indians, in which the prevalence of diabetes is large and the age of onset is relatively low. In the United Kingdom such a study would take over 50 years to complete. The prospective study of non-insulin dependent diabetes currently under way in Ely, Cambridgeshire, may eventually provide some answers.

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Home nebulisers in childhood asthma: survey of hospital supervised use

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Abstract

Objective—To review the management of and outcome in asthmatic children using home nebulisers under hospital supervision.

Design—Postal questionnaires sent to parents.

Setting—Paediatric departments of a children's hospital and a district general hospital.

Subjects—Parents of 93 asthmatic children who had been loaned home nebulisers for administration of bronchodilators with verbal instructions on their use.

Main outcome measures—Drugs administered with nebuliser, side effects, frequency of hospital admission, and theoretical management of a severe attack.

Results—84 children took salbutamol and 37 received more than 10 mg a day during attacks; side effects were reported in 54 children. Parents of 16 children said that they would give another dose of bronchodilator rather than seek medical help if their child failed to respond to the first dose. Since being loaned nebulisers 65 children were admitted to hospital less frequently and 16 were not readmitted; over two thirds of parents thought that there had been a marked improvement in their child's asthma.

Conclusions—Home nebulisers are valuable in childhood asthma. Excessive doses of bronchodilators may be given, however, and a weight related dose may be more appropriate. Parents should be given written as well as verbal instructions, especially regarding the management of severe attacks.

Introduction

Nebulisers are the most effective way of administering bronchodilators during an acute asthma attack.¹ They are the main method of treating preschool children with severe or moderately severe asthma, who are often unable to manage other inhalation devices effectively.² Paediatric departments of many hospitals and some general practitioners now loan nebulisers for use at home. Although this practice may reduce hospital admissions,³ the parents are then more responsible for managing their child's asthma.

Failure to recognise the severity of asthma and delay in starting other treatments have been recognised as important contributory factors in deaths from

asthma.^{4,5} A district hospital survey of asthmatic patients using home nebulisers in Britain, including 22 children under 7 years, showed confusion among patients about when and how to use the nebuliser, a lack of hospital supervision, and excessive use of bronchodilators in some patients.

I reviewed the management of asthma and outcome in a group of children using home nebulisers under hospital supervision, paying particular attention to dose of bronchodilator, prevalence of side effects, and the parents' understanding of how to manage a severe asthma attack.

Subjects and methods

I studied asthmatic children who received regular medical supervision from a district general hospital or a nearby children's hospital. The decision to lend children a home nebuliser was made by the consultant in each case. The loan and yearly servicing of the nebulisers was arranged by the community nursing service based at the children's hospital. The nurses verbally instructed each family on the use and maintenance of the nebuliser. Parents were told never to exceed the prescribed dose, never to give the dose more often than four hourly, and to seek medical advice or bring the child to hospital if there was no improvement after the first dose of bronchodilator. Parents were not routinely given written instructions, although 12 parents were given individual written guidelines.

Results

One hundred and twelve children were using home nebulisers, and the parents of 107 (96%) completed a postal questionnaire (box). Ninety three children were using nebulisers to take bronchodilators.

The children were aged from 1.2 to 14.7 (median 4.7) years, and the male to female ratio was 2:1. They had used home nebulisers for 0.2 to 8.7 (1.6) years. All but four children had been admitted to hospital with asthma at least once before being loaned a nebuliser. The two most common nebulisers used were the Porta-Neb 20 (40 children) and the Porta-Neb Multivolt (37 children), both made by Medic-Aid, Chichester. Eighty four children took salbutamol, six ipratropium bromide, and three terbutaline through the nebuliser.

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Seventy one children used the nebuliser at least once a day; in 59 this was for prophylactic drugs (sodium cromoglycate or beclomethasone).

Forty children took bronchodilators more than four times a day during an attack. Table I shows the total daily doses of salbutamol taken by the children during an exacerbation; one child aged 26 months took up to 22.5 mg and one aged 5 years took up to 30 mg. A 14 month old child took up to 15 mg a day of terbutaline and another aged 11 years took up to 60 mg a day during an attack.

TABLE I—Maximum daily dose of salbutamol taken by 84 children during asthma attacks

Age of child (years)	Maximum daily dose (mg)			
	<5	5-10	11-15	>15
<2	3	1		
2-4	5	23	8	2
5-10	2	10	21	4
>10	1	2	2	

The parents of 54 children observed side effects when their children used the nebuliser. The commonest effects were hyperactivity or restlessness (30 children) and tremor (24 children). Also mentioned were vomiting, tearfulness, drowsiness, and aggression.

In response to the question on their action if their child failed to respond to or relapsed within one hour of a dose of nebulised bronchodilator 77 parents said that they would take their child to hospital or seek medical advice immediately. Sixteen parents, however, said that they would give a further dose of bronchodilator; of these, six would do so immediately and 10 would delay it for four hours.

Most children were admitted to hospital less often than they had been before they had the home nebuliser, and 16 had no further admissions (table II). In 64 cases parents thought the nebuliser had appreciably improved their child's asthma. In only three cases did parents think that there had been no improvement.

TABLE II—Changes in frequency of hospital admissions after obtaining a home nebuliser on loan

Hospital admissions*	No of patients	Median (range) duration of loan (years)
Less frequent	65	2.3 (0.2-8.7)
More frequent	8	0.5 (0.2-1.8)
No further admissions	16	0.8 (0.5-3.5)

*Four patients were never admitted.

Discussion

My study shows that home nebulisers are valuable in treating childhood asthma. Most children were admitted to hospital less often, and their parents thought that their asthma had improved. A few children were admitted more frequently, but they had only recently been loaned nebulisers and were therefore more likely to have been at the peak of their illness.

The study also highlights two aspects of management that could be improved. Firstly, the amount of bronchodilator given through home nebulisers needs reappraisal. Laroche *et al* showed excessive use of nebulised bronchodilators,⁶ and over a third of children in my study received more than 10 mg a day

Details asked for in postal questionnaire

- 1 Details about nebuliser: age of child when loaned; type; and drug(s) used for, dose, and frequency of dose
- 2 Additional (non-nebuliser) drugs taken
- 3 Side effects of using nebuliser (hyperactivity, restlessness, tremor, vomiting, other)
- 4 Theoretical management of an acute attack failing to respond to or relapsing within one hour of a dose of nebulised bronchodilator. Parents were asked to choose from the following responses: seek further medical advice, take child to hospital, give another dose of bronchodilator immediately, wait four hours then give another dose of bronchodilator, or other action (describe)
- 5 Number of admissions to hospital before and after getting home nebuliser
- 6 Change in child's asthma since had home nebuliser: marked, some, or no improvement

of salbutamol during attacks and side effects were reported in 54 children. Although an asthma attack could produce restlessness, most of the reported side effects were probably due to excessive doses of bronchodilators. Nearly all the children took nebulised salbutamol, yet there is little data on the safe dose in children. Several authors suggest 2.5 mg salbutamol four times a day,^{7,8} but a dose related to weight may be more appropriate—for example, 50 to 150 µg per kg body weight up to four times a day.⁹

Secondly, the parents needed better education in managing an acute attack. Parents' theoretical responses show that almost a fifth would have reacted inappropriately. Their delay in seeking medical help and administration of a further dose of bronchodilator could have toxic or even fatal consequences. Although parents had been given correct verbal instructions when loaned the nebulisers, these were not routinely backed up with written instructions, allowing them to forget or misinterpret what they had been told.

Although home nebulisers are valuable in childhood asthma, weight related dose of nebulised salbutamol and written as well as verbal instructions for parents, especially regarding management of a severe attack, are needed. Evaluation of parents' real, as opposed to theoretical, responses to asthma attacks might show further ways in which the instructions and support they are given could be improved.

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