

Salbutamol by Powder or Spray Inhalation in Childhood Asthma

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Forty-three children from 3-16 years of age suffering from moderate bronchial asthma completed a double-blind cross-over study on the clinical effect of inhaled salbutamol (Ventoline[®]) powder (0.2 mg/dosis) compared with spray (0.1 mg/dosis) over two 4-week periods. Both administrations gave significant improvement in air flow meter (AFM) results. There was no significant difference between the periods on active powder or spray regarding daily symptom scores, adjuvant medication or AFM values. The powder caused cough in four children but in 12 of 28 children it was considered as easy or easier to accept as the spray; nine of these 12 children were younger than 10 years of age. It is concluded that salbutamol inhaled as a powder is a useful alternative when using a spray is difficult or unwanted.

Key words: asthmatic children; bronchodilator; powder inhalation; spray inhalation.

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Salbutamol (Ventoline[®]) is a β_2 -receptor stimulant with documented efficacy in the treatment of asthmatic children (5). Inhalation by means of a spray gives rapid relief of symptoms but requires practice and proper technique (3). Sodium cromoglycate (Lomudal[®]) can be inhaled in powder form from a Spinhaler even by patients who have difficulties using a spray (8).

The aim of our trial was to test the effect of salbutamol when inhaled as a powder (via a Rotahaler) and to compare it with the spray administration form in asthmatic children who regularly use β_2 -receptor stimulants. The study was carried out at the pediatric outpatient departments of the hospitals in Linköping and Motala during the winter of 1977-1978.

MATERIAL

Forty-seven children aged between 3 and 16

years were selected from among patients attending the outpatient clinics with a history of verified polyvalent asthma for at least 2 years and receiving regular treatment with β_2 -receptor stimulants. Forty-three children completed the study (32 boys and 11 girls; mean age 9.6 ± 3.7 years). Eleven of them were below 7 years. Four children did not complete the study, owing to intercurrent disease (1), inadequate technique (1) and lack of cooperation (2). Most of the children were familiar with the use of a spray and 29 had used Lomudal. During the trial 20 children were on Lomudal and eight on treatment with inhaled steroids.

Twenty-eight of the children were followed in Linköping (group 1) and 15 children in Motala (group 2).

The study was approved by the Ethical Committee of the Medical Faculty and through informed consent in writing from the children's parents.

METHODS

The trial took the form of a randomized double-blind, crossover study consisting of two 4-week periods with double placebo for spray and powder. All previous oral medication with β_2 -receptor stimulants and theophylline products was stopped and the children were put on regular inhalation of salbutamol, 3–6 doses per day according to need. Each spray dose gave 0.1 mg and each gelatine capsule (with lactose as the vehicle) 0.2 mg salbutamol in powder form. The powder was inhaled by means of a Rotahaler, which splits the capsule and allows the powder to be inhaled in 1–2 inhalations.

The children and their parents were instructed to use both spray and powder each time they used an inhaler, thus ensuring intake of active salbutamol every time.

The number of doses and all other medication were recorded each day on a symptom card. Any symptoms during the night, early morning and day (wheezing, cough and influence on activity) were also recorded on a 4-point scale (0 = no symptoms). Pulmonary function was measured with an airflow meter (AFM) each morning and evening before and 10 min after inhalation of spray and powder. Any infection or side effects of the medication were also noted.

Each 4-week period was concluded with a visit to the clinic when the parents were asked to return any remaining capsules and sprays. In group 1 the child's general condition and pulmonary function (AFM and peak

expiratory flow, PEF) and any preference for the two modes of administration were recorded.

The code was not broken until the entire trial had been completed. The period of treatment with active powder was compared with the period with active spray with respect to symptom score, AFM values and medication, using a linear nonparametric permutation test for paired observations (1). The AFM and PEF values at the visits to the clinic were compared using Wilcoxon's test for paired observations.

RESULTS

The number of doses (spray plus powder) did not differ significantly between the two periods (on active spray: 3.2 ± 0.6 ; on active powder 3.3 ± 0.6). Adjuvant medication (Lomudal, steroids, β_2 -receptor stimulant, theophylline derivatives, antibiotics) was also similar (Table 1). There was no significant difference between the periods in the number of doses of any drug. The asthmatic condition (night, early morning and day) showed no statistically significant differences between the periods of treatment with active powder and spray (Table 2).

The AFM values rose on an average by 28.1–37.3% 10 min after inhalation of spray and powder (Table 3). The improvements achieved did not differ significantly between the periods with active powder and spray.

The AFM values differed in respect of one variable only: the AFM value in the morning,

Table 1

Adjuvant medication. Number of children on different drugs

Adjuvant medication	Administration	Active powder	Active spray	P
Lomudal	inhaled	20	20	ns
Steroids	inhaled	8	8	ns
β_2 -receptor stimulants	oral	14	13	ns
Theophylline derivations	oral/rectal	7	8	ns
Antibiotics	oral	3	2	ns

ns = non significant

Table 2

Symptom scores (mean values $\pm$ standard deviation) for the asthmatic condition

	Active powder	Active spray	P
Night	0.31 $\pm$ 0.35	0.30 $\pm$ 0.35	ns
Early morning	0.39 $\pm$ 0.36	0.38 $\pm$ 0.37	ns
Day: Wheezing	0.45 $\pm$ 0.41	0.43 $\pm$ 0.40	ns
Day: Cough	0.39 $\pm$ 0.35	0.39 $\pm$ 0.35	ns
Day: Activity	0.31 $\pm$ 0.36	0.26 $\pm$ 0.37	ns

ns = non significant

Table 3

AFM units. Daily registrations (mean values $\pm$ standard deviation)

	Active powder	Active spray	P
Morning, before	53.2 $\pm$ 49.4	50.9 $\pm$ 43.3	ns
after	71.0 $\pm$ 53.9	69.9 $\pm$ 48.7	ns
increase	17.9 (33.5%)	19.0 (37.3%)	ns
Evening, before	57.5 $\pm$ 51.1	55.0 $\pm$ 48.2	ns
after	73.7 $\pm$ 54.9	71.0 $\pm$ 49.5	ns
increase	16.1 (28.1%)	16.0 (29.0%)	ns

ns = non significant

before inhalation, during the first week was somewhat higher ($54.5 \pm 41.2/47.5 \pm 41.2$; $P < 0.05$) during the period of treatment with active powder.

The PEF and AFM values registered at the visits to the clinic (group 1) showed relatively small average differences between the measurements (Table 4) but the PEF values were significantly higher ($P < 0.05$) at the end of the period of treatment with active powder compared to the spray period. Technically, the spray was considered easier to use by 21 out of 28 in group 1, whereas 12 out of 28 found it as easy or easier to get the child to take the powder (Table 5). Most of the children preferred to use a spray in the future but 10 out of 28 in group 1 wished to continue using capsules, and in the age-group 3-10 years ($n = 14$) four children found it easier to use the powder and five considered powder and spray equally good. Children over the age of 10 years

Table 4.

Pulmonary function during visits to the clinic in group 1 (mean values $\pm$ standard deviation)

	Active powder	Active spray	P*
AFM units	73.5 $\pm$ 55.1	69.9 $\pm$ 49.4	ns
PEF l/minute	314.6 $\pm$ 102.3	209.2 $\pm$ 112.3	< 0.05

*Wilcoxon's test for paired observations

ns = non significant

Table 5.

Preferences for powder or spray (group 1)

	< 10 years	> 10 years	Total
Technically			
spray	8	13	21
powder	5	1	6
equal	1	0	1
total	14	14	28
Easiest*			
spray	5	11	16
powder	4	2	6
equal	5	1	6
total	14	14	28

*Easiest = easiest to get the child to take.

preferred the spray considerably more often (11 out of 14).

Only one child was reported to have had side effects in the form of slight tremor (during the first 3 days on active powder), while inhalation of the powder caused cough in four out of 43.

DISCUSSION

Inhalation of salbutamol powder by means of a Rotahaler gave as good clinical results as the inhalation of spray in this double-blind trial comprising two 4-week periods. The average bronchodilator effect, measured with an AFM, of 0.2 mg salbutamol in powder form was almost identical to that given by 0.1 mg in spray form. This result is consistent with other findings in children (6). Adults who had difficulties using a spray also responded to salbutamol inhaled from a Rotahaler (4).

The trial shows that salbutamol in powder form is a useful alternative for asthmatic children who have difficulties using a spray, especially younger children (up to 10 years). The powder may also be recommended for use when the suitability of a spray is considered questionable in view of the freon contained (2, 7).

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