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Reversibility of airways obstruction in bronchiectasis

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Nogrady, S G, Evans, W V, and Davies, B H (1978). *Thorax*, **33**, 635–637. **Reversibility of airways obstruction in bronchiectasis.** Patients with airways obstruction and bronchiectasis were investigated for features of allergic disease and for reversibility of airways obstruction in response to inhaled and intravenous salbutamol. There was a 26% increase in PEFR and a 16% increase in FEV_1 after inhaled salbutamol, and the response to the intravenous drug was not significantly better than that to the inhaled. Those patients who responded to bronchodilators could not be identified by clinical or immunological features.

The common symptoms of patients with bronchiectasis are cough with sputum and dyspnoea. The former symptoms are usually well controlled with antibiotics and postural drainage. Dyspnoea varies in severity and is often associated with wheezing, which may simulate asthma. In another paper we report that an analysis of the protein patterns in the sol phase of sputum in some patients with bronchiectasis are typical of the pattern seen in asthma (Brogan *et al*, 1978).

The present study was designed to assess the reversibility of airways obstruction to beta-adrenergic stimulants in bronchiectatic patients and to investigate them for any evidence of allergic disease.

Methods

Sixteen patients (eight men and eight women, age range 30–45 years, mean 42 years) with bronchiectasis gave informed consent to participation in the study. Bronchographic confirmation of the diagnosis had been previously made in 14, and the appearances are shown in table 1. The other two patients had a compatible clinical and radiographic picture of the disease.

CLINICAL ASSESSMENT

All patients completed a questionnaire noting age of onset, smoking history, cough frequency, sputum volume and character, haemoptysis, and dyspnoea. Specific inquiry was made for the variability of dyspnoea, wheezing, nocturnal attacks, and response to other identifiable precipitants. A history of atopic eczema, hay fever, nasal polyposis, and a family history of asthma was noted in each patient.

Table 1 *Distribution of bronchographic appearances*

Case No	*Distribution*
1	LLL
2	RUL, lingula
3	RUL
4	RUL, LUL, RLL, lingula
5	RLL
6	LLL, lingula
7	RUL, RML, lingula
8	LLL, RLL, RML, lingula
9	Lingula, LLL, RML
10	LUL, RUL, RML, lingula
11	RLL
12	LLL, lingula
13	LLL, RLL, lingula
14	LLL, lingula

PULMONARY FUNCTION TESTS

Patients attended at the same time of day to reduce the effect of changes in lung function due to diurnal variation. Initial values of forced expiratory volume in one second (FEV_1), forced vital capacity (FVC), and peak expiratory flow rate (PEFR) were obtained using a dry wedge spirometer (Vitalograph) and a Wright peak flow meter. Static lung volumes were measured by helium dilution and the transfer factor by the single breath carbon monoxide test. Predicted normal values were obtained from Cotes (1975). Patients then inhaled, in random order and in a single-blind manner, either placebo (physiological saline 1 ml) or salbutamol (5 mg in 1 ml) administered by a Wright nebuliser driven by compressed air. Serial measurements of FEV_1, FVC, and PEFR were performed at 10-minute intervals for one hour, the static lung volumes and transfer factor being repeated at 30 minutes. At the end of one hour the second alternative inhalation was administered, and the tests were repeated.

The first nine patients were further studied to assess their response to intravenous salbutamol. Salbutamol (4 μg/kg) was given over 10 minutes using a constant infusion pump, and the patients were assessed as for the inhalation.

In addition, all patients measured their PEFR at home for two weeks by a peak flow gauge (Airmed) to assess spontaneous diurnal variation.

ALLERGIC FEATURES

Prick skin tests were performed using commercial extracts of house dust, *Dermatophagoides pteronyssinus*, mixed grass, pollen, cat fur, feathers, and *Aspergillus fumigatus*. Venous blood was taken for total IgE and specific IgE to *A fumigatus* using the Radio Allergen Absorption Test (RAST). *A fumigatus* preciptins were assessed by agar gel immunodiffusion. An eosinophil count was measured.

The sputum was cultured for *A fumigatus* and also fixed in 70% alcohol and stained for identification of asthmatic stigmata (Sanerkin and Evans, 1965).

Results

CLINICAL ASSESSMENT

Patients were graded on a simple linear score on the basis of four indices. These were: onset of symptoms before age 5 years (10 patients); the presence of pulmonary crackles (six patients); the radiological involvement of four or more lobes (for this purpose the lingula was considered a separate lobe) (three patients); and a history of cigarette smoking (four patients). Twelve patients had relatively mild bronchiectasis, while four had more severe disease.

PRESENCE OF AIRWAYS OBSTRUCTION

The group as a whole exhibited moderate airways obstruction. The mean baseline PEFR was 293±133 l/min and mean baseline FEV_1 was 1·83±0·92 l. Mean baseline RV/TLC ratio was 45·6±16·5.

REVERSIBILITY OF AIRWAYS OBSTRUCTION (table 2)

After inhalation of salbutamol aerosol there were mean percentage increases in PEFR and FEV_1 of 25·8 and 16·4% respectively. This was significantly greater than the response to placebo. The increase in FVC after salbutamol inhalation was not significantly greater than after placebo.

The increase in these measurements after salbutamol infusion did not differ significantly from the response obtained with inhalation. There was no significant change in RV, RV/TLC ratio, or transfer factor after either inhalation or infusion.

Reversibility of airways obstruction was unrelated to clinical grading. It followed the pattern described by Hume and Gandevia (1957). Those with near normal lung function showed little reversibility. While some severely obstructed patients did not reverse, those with moderate obstruction showed the greatest reversibility.

Table 2 *Reversibility of airways obstruction*

		Mean percentage increase		
		PEFR	*FEV_1*	*FVC*
Placebo	(a)	8·7± 7·5	6·3± 7·4	7·1± 7·2
Salbutamol inhalation	(b)	25·8±26·3	16·4±15·8	15·4±23·7
Salbutamol infusion	(c)	18·4±15·0	10·8± 5·6	20·2±14·4
P (a) versus (b)		0·02	0·05	NS
P (b) versus (c)		NS	NS	NS

FEATURES OF ALLERGIC DISEASE (table 3)

Patients were divided into allergic and non-allergic groups of six and ten patients respectively. The former was made up of patients who had one or more of the following: nasal polyposis, asthmatic stigmata in sputum, atopy by prick skin testing, blood eosinophilia of greater than 400 cells/mm^3 or a raised total serum IgE of greater than 200 IU/ml. There was no significant difference in baseline PEFR, FEV_1, or RV/TLC or in response to salbutamol between the two groups.

No patients had evidence of colonisation with *A fumigatus*, either from sputum culture, specific IgE or precipitin tests.

Table 3 *Clinical and immunological features*

Asthmatic stigmata	1	Episodic wheeze	14
Atopic skin tests	3	Nocturnal wheeze	5
Blood eosinophilia	1	Family history of asthma	3
Raised total IgE	3	Smokers	3
Nasal polyposis	4		

DIURNAL VARIATION

Diurnal variation was assessed as the mean maximum percentage change in PEFR occurring spontaneously through the day. Over the group this represented a change of 8·6±11·3%. Four patients had a spontaneous variability of greater than 10%. Two of these were in the allergic and two in the non-allergic group.

Discussion

We have shown a significant reversibility of air-

ways obstruction after inhalation of salbutamol in patients with bronchiectasis. This reversibility is related to the baseline severity of the airways obstruction and is in keeping with results in patients with asthma. We were unable to relate any of the clinical or immunological features to the severity of the airways obstruction or to their response to salbutamol.

The mechanism of airways obstruction in bronchiectasis is not understood, although it has been suggested that mucosal oedema and glandular hyperplasia, excessive airways collapse in expiration, or bronchospasm may all be important. Changes of peribronchial fibrosis, oedema, inflammation, and mucous gland hypertrophy are usually more widespread than bronchographic appearances suggest (Thurlbeck *et al*, 1970).

Previous studies of inhaled and systemic bronchodilators in bronchiectasis have been infrequent. Cherniak and Carton (1966) showed negligible changes in FEV_1, FVC, or RV after inhalation of isoprenaline, while Pande *et al* (1971) showed no significant change in inspiratory or expiratory pulmonary resistance or dynamic compliance.

We would suggest that all patients with bronchiectasis should have an assessment of the reversibility of airways obstruction by beta-adrenergic stimulants, preferably by inhalation.

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