

RESEARCH POINTERS

Peak expiratory flow sequence in acute exacerbations of asthma

The effect of deep inspiration on airway calibre in asthma may be a marker of the pathophysiology of airflow obstruction. Dilator responses occur with predominant airway smooth muscle spasm,¹ and constrictor responses with more severe inflammatory bronchoconstriction.² We investigated whether the effect of deep inspiration, as reflected by the change in peak expiratory flow from the first to last of a sequence of three blows, in acute exacerbations of asthma is a marker of more chronic bronchoconstriction and longer length of stay in hospital.

Participants, methods, and results

We recruited 43 successive patients presenting with acute exacerbation of asthma to two hospitals (table). Peak expiratory flow was measured with the patient seated and using a mini-Wright flow meter. The measurement was taken as the best of three blows from total lung capacity with no breath hold. Admitting staff were trained in the technique and were asked to record all three blows and to ensure there was a gap of < 10 seconds between blows. We derived a last to first peak expiratory flow ratio by dividing the third peak expiratory flow by the first and related the log of the ratio to length of stay by multiple logistic regression with admission peak expiratory flow (percentage of predicted flow) and British Thoracic Society stage as independent variables. The medical management of acute asthma was based on the British Thoracic Society guidelines.

Fifteen patients had a last:first peak expiratory ratio < 1, and 28 had a ratio \geq 1. Admission characteristics were similar in the two groups except for British Thoracic Society stage (table). The median length of stay for the group with a ratio < 1 was three days compared with one day for the group with a ratio \geq 1 (95% confidence interval of difference 1 to 3 days; $P = 0.003$). Multiple regression showed that admission percentage predicted peak expiratory flow ($r = -0.51$, $P = 0.001$) and log last:first ratio ($r = -0.53$, $P = 0.001$) but not British Thoracic Society stage ($r = 0.26$, $P = 0.1$) were independently related to length of stay.

Comment

We have shown that the last:first peak expiratory flow ratio derived from three sequential readings is an independent predictor of length of hospital stay in acute exacerbations of asthma. Our arbitrary subdivision at a ratio of 1 identifies easily defined subgroups who have an important difference in outcome but who do not differ in traditional prognostic markers.

The change in peak expiratory flow with repeated blows could have several explanations. These include

the effects of fatigue, timing, and technical limitations of peak expiratory flow recordings. The association with outcome suggests that the change in flow is likely to reflect a physiological phenomenon such as the effects of deep inspiration on airway calibre. This may be due to relative uncoupling of the airway and lung parenchyma because of inflammation of the airway, with parenchymal hysteresis exceeding airway hysteresis transiently after inspiration.³ Patients with a low ratio therefore might have recovered more slowly because their bronchoconstriction had a greater inflammatory component. Further work is required to determine the mechanism of this phenomenon and to validate whether use of this simple measure improves patient outcome.

We thank the medical and nursing staff at Glenfield and Kettering General Hospital for identifying patients for the study and asthma nurse specialist Jo Spencer for following up patients.

Contributors: SSB contributed to overall design of protocol, collection of data, and statistical analysis and wrote the paper. CEB contributed to the design of the protocol, data collection at the Glenfield site, and statistical analysis and reviewed the manuscript. EH was responsible for planning the study and data collection at the Kettering site and reviewed the manuscript. TJW participated in the planning of the study at the Kettering site and revised the manuscript. IDP had the original concept, designed the protocol, participated in data collection and analysis, reviewed the manuscript, and is the guarantor.

Funding: None.

Competing interests: None declared.

- 1 Lim TK, Pride NB, Ingram RH. Effects of volume history during spontaneously and acutely induced airflow obstruction in asthma. *Am Rev Respir Dis* 1987;135:591-6.
- 2 Pellegrino R, Violante B, Crimi E, Brusasco V. Effects of deep inhalation during early and late asthmatic reactions to allergen. *Am Rev Respir Dis* 1990;142:822-5.
- 3 Burns CB, Taylor R, Ingram RH Jr. Effects of deep inhalation in asthma: relative airway and parenchymal hysteresis. *J Appl Physiol* 1985;59:1590-6.

(Accepted 14 March 2001)

Peak expiratory flow sequence in acute exacerbations of asthma predicts length of hospital stay

Department of Respiratory Medicine, Kettering General Hospital, Kettering, Northamptonshire NN16 8UZ
Surinder S Birring
specialist registrar
Ernest Heartin
senior house officer
Tim J Williams
consultant physician

Institute for Lung Health, Department of Respiratory Medicine, University Hospitals of Leicester NHS Trust, Glenfield Hospital, Leicester LE3 9QP
Christopher E Brightling
specialist registrar
Ian D Pavord
consultant physician and honorary senior lecturer

Correspondence to: S S Birring sb134@le.ac.uk

BMJ 2001;322:1281

Patient characteristics and admission data

	Last:first peak expiratory flow		95% CI of difference	P value
	<1	\geq 1		
No of patients (No of men)	15 (4)	28 (10)	—	—
Mean age (years)	37	31	-1 to 12	0.1*
Median duration of asthma (years)	16	17	-5 to 7	0.8†
Median BTS stage	4	2	0 to 2	0.001‡
Mean admission peak expiratory flow (% of predicted)	42	50	-19.1 to 2.5	0.1*
Mean peak expiratory flow after nebulised salbutamol (% of predicted)	49	59	-25 to 4	0.1*
Mean peak expiratory flow at discharge (% of predicted)	75	70	-10 to 20	0.52*
No (%) admitted to hospital	14 (93)	18 (64)	—	0.03‡
No (%) requiring intravenous aminophylline	6 (40)	2 (7)	—	0.008‡

*Two sample *t* test.

†Mann-Whitney U test.

‡ χ^2 test.

BTS=British Thoracic Society.