

Evening Dip of Peak Expiratory Flow in Patients with Asthma

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ABSTRACT

Background: Circadian rhythm is a well recognized feature of patients with asthma characterized by a morning dip of the peak flow rate. However, evening dips of asthmatic patients have never been systematically studied.

Methods: We prospectively studied the frequency and clinical characteristics of asthma patients with evening dips. The records of 229 patients for two months were analyzed.

Results: Fifty four patients (23.6%) had repeated evening dips. Comparison of the groups with or without evening dips revealed that the group of patients with evening dips were younger (mean age, 47.3) and had higher asthma steps (mean 2.46) compared to the other group (56.2 and 1.93, respectively). Self-reported causes of evening dips were related to work overload (24.1 %), exercise (9.3%), mental stress (7.4%), allergen exposure (5.5%), cold air (3.7 %), alcohol (3.7%), and unknown (38.8%). Evening dips of peak flow are often related to the daily activity of patients.

Conclusions: Detection of evening dips might be useful to give specific advices to the patients, and be helpful for the prevention and control of asthma exacerbation.

KEY WORDS

bronchial asthma, evening dip, peak flow

INTRODUCTION

It has been recognized that asthma is a cyclical condition,^{1,2} with the typical manifestations of asthma occurring during night and early morning.³ Serial measurements of peak expiratory flow (PEF) are widely used in the clinical management of asthma to aid diagnosis, to assess severity, and to help identify provocative factors.^{4,8} It has been suggested that a diurnal variation in PEF of 20% or more identifies asthmatic subjects.⁴ Asthmatic subjects with or without regular inhaled treatment are reported to have minimal PEF in the morning (from 4 : 00 to 10 : 00 depending on their treatments) and maximum in the late afternoon (from 15 : 00 to 17 : 00).^{3,9} Large diurnal changes in PEF or a large amplitude of "morning dip" are known to be associated with severe attacks of asthma and with increased mortality.^{8,10} The nocturnal worsening of asthma is reported to be linked with the amplitude of the dip.¹¹

Although it is well accepted that PEF may decrease after exercise in patients with exercise induced asthma, or after exposure to outside allergen, "evening dip" has never been systematically studied nor has been established as a pattern of PEF. The hypothesis of this study was that evening dip might be a useful marker for screening provocation factors in patients with asthma. We examined serial PEF recordings in patients with asthma to study the frequency of evening dip, their causes, and patient characteristics with or without evening dips.

METHODS

SUBJECTS

We recruited 229 asthmatic subjects from consecutively seen outpatients at Saitama Cardiovascular and Respiratory Center. All asthmatic subjects fulfilled the criteria of the Global Initiative for Asthma (GINA). Baseline spirometric values were assessed according to standardized criteria for all subjects.

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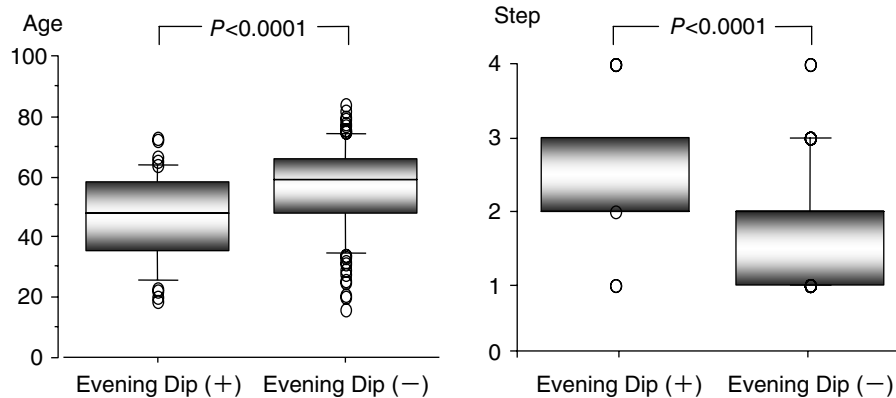
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Received 31 August 2004. Accepted for publication 9 December 2004.

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Table 1 Subjects Characteristics with or without Evening Dip in Asthmatics

	Evening Dip (+)	Evening Dip (-)	
Number	54 (23.6%)	175 (76.4%)	
Male/Female	22/32	84/91	
Atopic/Nonatopic	37/17	123/52	
Duration of asthma	10.3 ± 1.4	11.2 ± 1.1	NS
%FVC	96.8 ± 2.4	94.0 ± 1.5	NS
%FEV1	81.1 ± 4.4	77.8 ± 2.3	NS
FEV1/FVC (%)	70.4 ± 2.9	68.6 ± 1.8	NS
Morning PEF	373 ± 16	366 ± 9	NS
Evening PEF	399 ± 15	384 ± 10	NS
Amplitude of PEF (%)	6.9 ± 0.6	5.2 ± 0.3	$p=0.0026$
PFR, best/predicted	0.95 ± 0.02	0.93 ± 0.02	NS

**Fig. 1** Comparison of age and severity of asthma between asthmas subjects with evening dips ($n=54$) and asthmas subjects without evening dips ($n=175$). Severity of asthma was classified by GINA guideline.

The study was approved by ethics committee of the hospital, and all subjects gave informed consent.

PEF was recorded with Personal Best peak flow meters (Respironics, NJ, USA). Each subject given a peak flow meter was instructed in its use. All measurements were made with the subject upright, and we recorded the best of three maximal expirations into the peak flow meter. All subjects were asked to record their PEF at least twice a day, after waking in the morning, before the use of any drug (7 : 00–9 : 00), and in the evening before the use of any drug (17 : 00–19 : 00). They were asked to do the measurement at the same time each day, and to record their symptoms and daily events that might influence asthmatic symptoms. These events included exercise, allergen exposure, symptoms of cold, alcohol, mental stress, and any other events that they thought might influence their symptoms.

Asthma steps were determined by the GOLD guideline.

ANALYSIS

All records of least two readings a day for two months were analyzed.

The mean highest PEF and mean lowest PEF throughout the study period were calculated for each subject. The evening dip was defined as follows.

Evening dip : (morning reading) > (evening reading), and (morning reading) – (evening reading) > 10% of the morning reading.

Evening dips were considered as significant if the difference of the average evening reading of a week without evening dips and the evening reading of the day are more than 20% of the reading at morning.

The evening dipper group was defined as the subjects who had evening dips repeatedly during the observation period. If reported events and evening dips were repeatedly observed with the same timing, these events were judged as the causes of evening dip.

CASE REPORTS

In case reports two records of asthmatics with typical evening dip were analyzed.

Statistics

Demographic data for the subjects were expressed as means and SE. The Mann-Whitney test was used for

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