

LETTER TO THE EDITOR

EXPIRATORY FLOW RATE CHANGES DURING THE MENSTRUAL CYCLE

Sir,

(Received on January 29, 1991)

In women, the mortality and morbidity from asthma varies with the phases of the menstrual cycle. Exacerbation of symptoms, and higher incidence of attacks have been reported during the premenstrual and menstrual phases (1). Forced expiratory flow rates in asthmatics have been shown to decrease during the premenstrual phase, indicating a higher bronchomotor tone at this time (2). Whether this occurs in normal women is not known. The study reported here was therefore undertaken to identify changes in flow rates during the menstrual cycle in a group of normal young women.

Fourteen normal young medical students who had regular menstrual cycles and no history of atopy were chosen. The date of the last menstrual period and the data of the menstrual period following the study were recorded. Heights and weights were measured. Pulmonary function was tested twice a week using the Collins' respirometer and the Wright Peak flow meter. The parameters studied were the forced vital capacity (FVC), forced expiratory volume in 1 second (FEV_1), FEV_1 expressed as a percentage of FVC ($FEV_1\%$), forced expiratory flow rate at 25 to 75% of FVC (FEF 25-75%) and peak expiratory flow rate (PEF). PEF was tested on all subjects but spirometric testing for the full cycle was possible only on 9 subjects. All tests were done at the same time of the day to avoid possible diurnal variations.

The mean age, height and weight of the subjects were 18.0 (± 0.96) years, 158.9 (± 6.57) cms, and 4.95 (± 5.48) kgs, respectively. The menstrual cycle was divided into five phases designated backwards from the onset of the next

menstrual period, since the length of the progesterational phase is believed to be more constant than the length of the follicular phase (3).

| | |
|------------------|---|
| Menstrual | — 1st to 4th day of cycle. |
| Follicular | — 16th day prior to onset of next menstruation to the 5th day of the cycle. |
| Ovulation | — 10th to 15th day prior to onset of next menstruation. |
| Progesterational | — 4th to 9th day prior to onset of next menstruation. |
| Premenstrual | — 1st to 3rd day prior to onset of next menstruation. |

Table I shows the pulmonary function during the different phases of the cycle. Peak expiratory flow rates were significantly higher during the follicular phase and were lowest during the premenstrual phase. Similarly FEF 25-75% was significantly lower in the pre-menstrual and menstrual phases.

The low PEF and FEF 25-75% observed during the pre-menstrual and menstrual phases, indicate a higher bronchial tone during these phases even in normal women. The possible reasons for the changes in bronchial tone could be the fluctuating levels of sex hormones in the blood, or of the mediators circulating in the blood. The effects of sex hormones on bronchial smooth muscle are not well studied although progesterone has a smooth muscle relaxant effect (4) and its withdrawal may therefore be expected to cause low flow rates during the premenstrual and menstrual phases. In support of this, some studies have shown that

TABLE I : Pulmonary function during the menstrual cycle.

| | Menstrual phase | Follicular phase | Ovulation | Progestational phase | Premenstrual phase |
|---------------------------|-------------------|-------------------|-------------------|----------------------|--------------------|
| PEF, litres/min. | 404.7 (.38.06) | 419.6 (.42.27) | 407.2 (.38.96) | 404.1 (.39.15) | 401.7 (.40.37) |
| FVC, litres | 2.65 (.462) | 2.71 (.445) | 2.73 (.386) | 2.76 (.383) | 2.71 (.451) |
| FEV ₁ , litres | 2.33 (.425) | 2.43 (.357) | 2.38 (.367) | 2.43 (.390) | 2.39 (.352) |
| FEV ₁ % | 87.8 (5.91) | 89.9 (5.09) | 87.3 (6.26) | 87.7 (6.36) | 88.2 (6.14) |
| FEF 25-75% litres/sec | 2.72 (.716) | 2.91 (.593) | 2.87 (.619) | 2.98 (.746) | 2.77 (.585) |

Figures in parenthesis are standard deviations.

PEF was significantly lower during the premenstrual and menstrual phases as compared to the follicular phase, ($P < 0.05$).

FEF 25-75% was significantly lower during the premenstrual and menstrual phases as compared to the progestational and follicular phases respectively, ($P < 0.05$).

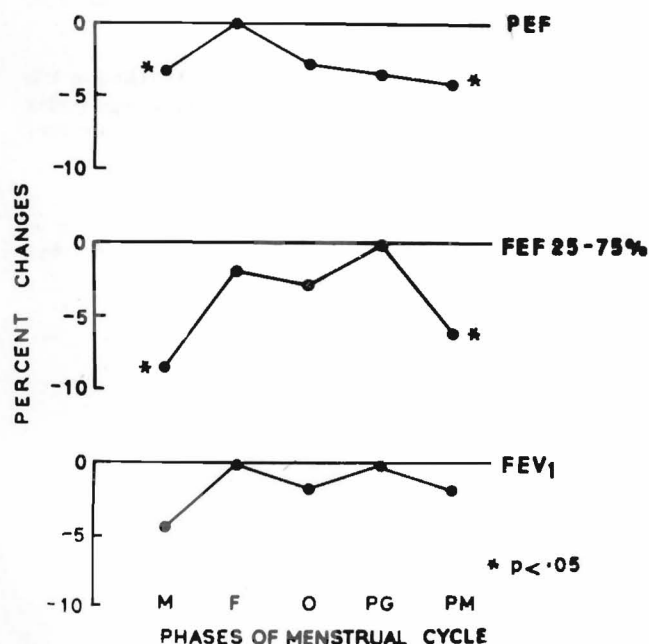


Fig. 1: Flow rate changes during the menstrual cycle.

Flow rate changes are expressed as percent changes.

M = 1st to 4th day of cycle.

F = 16th day prior to onset of next menstruation to the 5th day of the cycle.

O = 10th to 15th day prior to onset of next menstruation.

PG = 4th to 9th day prior to onset of next menstruation.

PM = 1st to 3rd day prior to onset of next menstruation.

progesterone therapy eliminates the premenstrual fall in PEF in asthmatic women (5).

Fluctuating levels of circulating mediators could also be responsible for the changes in bronchial tone. PGF₂ α , a powerful broncho-constrictor reaches its highest level in the endometrium premenstrually and menstrually (6). There is evidence that these endometrial changes may be reflected in the systemic blood (7). Other possible mediators are those held in the blood basophil reservoir such as leukotrienes and histamine which are also powerful broncho-constrictors. Although *in vitro* studies show that basophil releaseability is not affected by sex hormones (8) it is known that prostaglandins strongly modulate basophil degranulation (9, 10). An interplay of the factors could result in alterations in the bronchial tone during the menstrual cycle.

The finding that expiratory flow rates show significant fluctuations during the menstrual cycle in normal women, is an important factor to be taken into consideration in the designing of research protocols, and in assessment of deterioration or improvement in lung function by serial testing. It also indicates that women with a predisposition to respiratory allergies may be more prone to manifest

symptoms during the premenstrual and menstrual phases. This needs to be borne in mind during the management and planning of therapeutic regimens in asthmatic women.

Fund of the Christian Medical College. We thank the students who willingly participated as subjects in this study.

G. SUNDAR RAO, P. RAJAN AND S. WALTER*

ACKNOWLEDGEMENTS

This study was financed by the Fluid Research

*Department of Physiology,
Christian Medical College,
Vellore - 632 002*

REFERENCES

1. Eliasson O, Scherzer HH, DeGraff AC. Morbidity in asthma in relation to the menstrual cycle. *J All Clin Immunol* 1986; 77: 87-93.
2. Gibbs CJ, Coutts II, Lock R, Finnegan OC, White RJ. Premenstrual exacerbation of asthma. *Thorax* 1984; 39: 833-6.
3. Ganong WF. Review of Medical Physiology, 14th Ed. Prentice-Hall of India Private Ltd. New Delhi 1989.
4. Daignault PG, Fackas AG, Rosenthal L, Fried GM. Relationship between gall bladder contraction and progesterone receptors in patients with gallstones. *Am J Surgery* 1988; 155: 147-51.
5. Beynon HL, Garbett ND, Barnes PJ. Severe premenstrual exacerbations of asthma: effect of intramuscular progesterone. *Lancet* 1988; 2(8607): 370-72.
6. Downie J, Poyser NL, Wunderlich M. Levels of prostaglandins in human endometrium during the normal menstrual cycle. *J Physiol* 1974 236: 465-72.
7. Goldberg VJ, Ramell PW. Role of prostaglandins in reproduction. *Physiol Rev* 1975; 55: 325-51.
8. Slater JE, Kaliner M. Effects of sex hormones on basophil histamine release in recurrent idiopathic anaphylaxis. *J All Clin Immunol* 1987; 80: 285-90.
9. Peters SP, Naclerio RM, Schleimer RP, MacGlashan DW Jr, Pipkron U, Lichtenstein LM. The pharmacologic control of mediator release from human basophils and mast cells. *Respiration* 1986; 50: Suppl 2: 116-22.
10. Von der Helm D, Ring J, Dorsch W. Comparison of histamine release and prostaglandins E2 production of human basophils in atopic and normal individuals. *Arch Dermatol Res* 1987; 279: 536-42.

*Corresponding Author