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SHORT COMMUNICATION

EFFECT OF INSPIRATORY AND EXPIRATORY AIR FLOW ON CONGESTION AND DECONGESTION IN THE NASAL CYCLE

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Abstract : The role of the inspiratory and expiratory airflow through nostrils during the process of breathing in the reflex reciprocal congestion and decongestion of the nasal cycle was examined in this study. Air flow through each nostril was measured separately in male subjects before and after four types of breathing practices for 15 min each consisting of (1) inspiration through the patent nostril and expiration through the congested nostril, (2) inspiration through congested nortril and expiration through patent nostril, (3) inspiration through both nostrils and expiration through mouth and (4) inspiration through mouth and expiration through both nostrils. The breathing practices had no effect on the congested nostril but caused decrease in air flow through the patent nostril, indicating congestion. It is suggested that the inspiratory and expiratory air flow through the nostrils caused reflex congestion of the patent nostril. The stimuli arising from the nasal mucosa due to air flow during breathing may form the basis for the reflex reciprocal congestion and decongestion of nostrils in the nasal cycle.

Key words : nasal cycle congested nostril expiratory air flow patent nostril inspiratory air flow nasal mucosa

INTRODUCTION

Engorgement of the nasal venous erectile tissue determines the air flow through nostrils. Due to difference in the congestion in the nostrils, more air flows through patent nostril than the congested nostril. The nasal mucosa exhibits cycles of congestion and constriction which causes an alternation of air flow from one nasal passage to the other over a period of hours. This phenomenon was termed "nasal cycle" (1). Teleological explanation for the nasal cycle is that one nostril may rest while the other carries on the air-conditioning function of the nose (2). From the fact that the congestion of the nasal mucosa is determined by the activity of its sympathetic innervation (3), it may be assumed that the stimuli arising from the nasal mucosa during the breathing process may reflexely lead to the nasal cycle. As no evidence is available to support such assumption, the present work is intended to examine such a possibility.

METHODS

In 8 male subjects of 25–35 yrs age, anterior

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rhinomanometry was employed using a rhinomanometer (HR 1-mercury Electronics (Scotland), Ltd.) and the expiratory air flow through individual nostrils was measured in cm^3/sec at 150 Pascals pressure and average of ten such recordings was used as one observation, Normal, resting and quiet respiration was allowed for a period of 15 min as the subject relaxed in a sitting position. At the end of such a control period airflow through nostrils was measured. This was followed by a breathing practice for 15 min. Immediately after the breathing practice the airflow through nostrils was measured again. Expiratory air flow measured at the end of the resting period was the control observation taken immediately before the breathing practice. The experimental observation constituted the measurements taken at the end of the breathing practice. The changes were tested by applying Student's 't' test.

Only one of the following four types of breathing practices was allowed in a single experimental session.

Group I : Breathing practice– Inspiration through patent nostril and expiration through congested nostril.

Group II : Breathing practice– Inspiration through congested nostril and expiration through patent nostril.

Group III: Breathing practice– Inspiration through nose (both nostrils) and expiration through mouth.

Group IV: Breathing practice– Inspiration through mouth and expiration through nose (both nostrils).

Breathing during the above practices was quiet.

RESULTS

Breathing practices did not produce any significant change in the air flow through the congested nostril (Table I A). But there was significant decrease in air flow through patent nostril indicating congestion after the breathing practices. (Table I B). In group I and II the decrease in air flow was similar. The reduction in air flow in group III was more than group I and II and maximum in group IV.

TABLE I : Effect of Breathing Practices on the Expiratory Air Flow Through Nostrils.

Group	*Expiratory air flow cm^3/sec/150 Pascals (Mean±SE)*			
	Before	*After*	*Difference*	*p*
(A) *Through Congested Nostril*				
I	131.9±38.7	108.8±23.7	−23.1	NS
II	137.2±46.5	124.3±85.2	−12.9	NS
III	146.1±45.8	138.8±38.3	− 7.5	NS
IV	130.0±32.8	158.3±41.9	+ 8.9	NS
(B) *Through Patent Nostril*				
I	435.7±98.2	356.9±124.8	−78.8	<0.01
II	434.9±112.1	357.9±107.8	−77.0	<0.01
III	409.1±153.4	320.4±103.7	−88.7	<0.05
IV	400.0± 61.7	292.5± 45.6	−107.5	<0.01

These observations indicate that air flow through nostrils during inspiration and expiration may cause congestion of the patent nostrils. The results in group IV indicate that the expiratory air flow through the nostrils is likely to be more effective in causing congestion of patent nostril.

DISCUSSION

The presence of a cycle of congestion and decongestion of the nasal venous erectile tissue was first described by Keyser in 1895, who termed it "nasal cycle" (1). Since then the phenomenon of the nasal cycle was well documented in man, the rat, rabbit and the domestic pig (3, 4, 5). Stocksted (6) suggested that the nasal cycle was controlled by the fluctuations in the sympathetic activity. Unilateral section of the cervical sympathetic nerve abolishes the nasal cycle on both sides of the nose indicating that changes in the activity of mucosa on one side of the nose may influence the other side by a reflex mechanism (3). Connell (7) described a "reciprocal nasal congestion-decongestion reflex" in which a change in the resistance of one nasal passage caused a reciprocal change in the resistance of the other nostril. Hypothalamus was proposed as the centre for the sympathetic effects on nasal mucosa and nasal cycle (3).

In the present study, the possibility of inspiratory and expiratory airflow through the nostrils initiating the reflex mechanism of the nasal cycle was examined. The stimuli arising out of the air flow through nostrils during the process of breathing can be considered as the most naturally and commonly occuring stimuli to the nasal mucosa. Possibly the effect of inspiratory and expiratory air flow through the congested and the patent (less congested) nostril may vary. In this study, breathing practices consisting of (group I) inspiration through patent nostril and expiration through congested nostril, (group II) inspiration through congested nostril and expiration through patent nostril (group III) only inspiration through nose and (group IV) only expiration through nose, throw light on the role of inspiratory and expiratory air flow through nostrils.

Though none of the above breathing practices caused any significant change in the air flow through the congested nostril, they induced congestion in the patent nostril as evidenced by the significant decrease in air flow. The maximum reduction was seen in the Group IV. Hence it can be inferred that the inspiratory and expiratory air flow in the patent and congested nostrils cause congestion of the patent nostril and the expiratory stimuli from the nasal mucosa are possibly more effective than the inspiratory stimuli.

These results suggest the role of air flow through nostrils during breathing which lead to the reflex congestion of the patent nostril. Keeping in view the short duration (15 min) of the practices it may be postulated that when the effect accumulates over long period (a few hours), the hypothalamic centre may trigger the decongestion/congestion of nostrils. Thus it can be suggested that the stimuli arising from air flow through nostrils during the breathing process might from the basis for the periodic reciprocal congestion/decongestion pattern of the nostrils, i.e., the nasal cycle.

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