Indian J Physiol Pharmacol 1993; 37(1) : 147-150

SHORT COMMUNICATION

REFLEX REVERSAL OF NOSTRIL DOMINANCE BY APPLICATION OF PRESSURE TO THE AXILLA BY A CRUTCH

S. MITTI MOHAN*

Department of Human Physiology,
Ahmadu Bello University,
Zaria, Nigeria (West Africa)

(Received on November 16, 1992)

Abstract : Effect of pressure application by a crutch to the axilla of the side of the dominant right nostril on the pattern of nostril dominance with emphasis on the time sequence of changes and recovery was studied in the young male Nigerians. The nostril dominance was assessed from the percentage of tidal volume flowing through the right and left nostril passages during expiratory phase (7). Application of pressure to right axilla for 20 min caused tidal volume flowing through left nostril to change from the control value of 20.3 ± 15.8% (SD) to 74.1 ± 10.4% while the rest of the tidal volume passed through the right nostril. The effect started in the first minute; air flow through both nostrils was equalized by 4 min ; reversal of nostril dominance occurred thenceforth; and peak change was obtained by 17 min after application of pressure to the axilla. Removal of crutch could not lead to recovery.

Key words : nostril dominance, pressure to axilla, crutch, nostril air flow, nostril congestion, nasal cycle

INTRODUCTION

The term 'nasal cycle' refers to the phenomenon of periodic and alternate congestion and decongestion of the nasal mucosal venous erectile tissue (1). As the term 'nasal cycle' should essentially refer to the cyclical changes, Mitti Mohan (2) used the term 'dominant nostril' to refer to the nostril through which major percentage of tidal volume passed. This phenomenon was referred to as the 'nostril dominance'. The phenomenon of nostril dominance was extensively described in the ancient Indian literature of Yoga (3).

Rao and Potdar (4) demonstrated reduced ventilation through the down side of the nose in lateral recumbent position and the nostril on the side of axilla to which crutch pressure was applied. Bhole and Karambelkar (5) also showed that the air flow through nostrils was affected similarly when the crutch pressure was applied to an arm pit. Davies and Eccles (6) showed that the pressure application to the axilla by crutch caused a reciprocal change in the nasal resistance to air flow with an ipsilateral increase and contralateral decrease in resistance. Neither emphasis was laid on the time sequence of the changes nor observations on the recovery were reported in these studies. Earlier studies were either on Indian subjects (4, 5) or British subjects (6).

The present study was undertaken to examine the time sequence of the reversal of nostril dominance by application of pressure by a crutch to the axilla on the side of the dominant nostril and also the possibile recovery to the initial pattern of nostril dominance after the pressure in the axilla was removed. The study was on Nigerian subjects who differed in race from the subjects participated in the earlier studies (4, 5, 6).

METHODS

Eight normal healthy adult male Nigerians of age 18-21 years without any chronic or acute nasal disease

*Present Address : Institute for Yoga and consciousness, Andhra University, Vijayanagaram Palace, Pedda Waltair, Visakhapatnam - 530 023 (AP), India

were used in this study.

The nostril dominance pattern was assessed by the method described earlier by Mitti Mohan (7). Expired air from either nostril was seperately collected into two spirometers while the subject was breathing in the room air using a valve system. The tidal volume of a breath and the percentage of tidal volume flowing through the left and right nostrils during the expiratory phase were obtained from the record of the volume of expired air. An average of 3 breaths was taken for the assessment.

Design of the study :

Phase I : It is the initial control phase for 20 min with the subject in sitting position. Only those sessions in which the subject demonstrated right nostril dominance were continued for further experimentation.

Phase II : After the subject spent 20 min in the Phase I, the subject leaned on a wooden crutch kept under his right axilla for 20 Min. because the right nostril was dominant in Phase I.

Phase III : Crutch was removed from the axilla at the end of 20 min of phase II and the subject continued to sit on the stool as in the Phase I. Possibility of recovery was investigated during this period for 60 min.

The nostril dominance pattern was measured at one minute intervals in the Phase I, II and the initial 20 min of the Phase III. The observations in the later part of the Phase III (40 min) were made at 5 min intervals (See Fig. 1).

Statistical Analysis :

The mean of observations taken from 11th to 20th min. (n = 10) in the Phase I, II and III for each subject and group were compared and an one way analysis of variance was done by using unpaired Student's 't' test (Table I).

TABLE I: Effect of crutch application to right axilla on left nostril air flow.

(Data was accumulated over time for each subject & group)

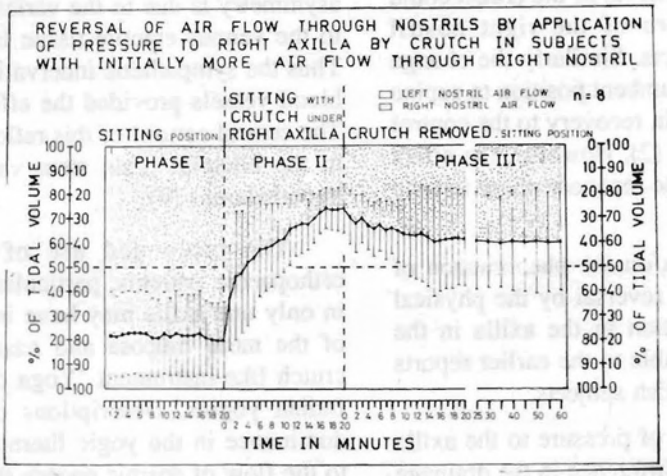
Subject	*Period of the experiment*			*#P - Value when compared between*		
	*I**	*II**	*III**			
	Mean	*Mean*	*Mean*	*I - II*	*II - III*	*I - III*
1	34.8	71.9	72.3	<0.001	NS	<0.001
3	21.5	69.0	61.3	<0.001	<0.001	<0.001
5	11.9	64.8	54.9	<0.001	<0.001	<0.001
7	27.3	65.9	70.2	<0.001	<0.05	<0.001
2	0	75.5	94.8	<0.001	<0.001	<0.001
4	0	65.6	70.3	<0.001	NS	<0.001
6	41.4	61.5	35.8	<0.001	<0.001	<0.001
8	35.1	90.4	36.3	<0.001	<0.001	NS
Group	21.5±16.1	70.6±9.1	62.0±19.7	<0.001	NS	<0.001

*Observations from 11-20th minute of I, II & III Phases respectively (See text)
#Unpaired student's t - Test was used.

RESULTS

The mean percentage and standard deviation of tidal volume flowing through the right and left nostrils during Phase I, II and III are represented in Fig. 1 to show the changes in the pattern of nostril dominance and its time sequence.

Phase I : As indicated earlier, the sessions in which the subjects showed more air flow through the right nostril were only considered. At the end of phase I the percentage of tidal volume flowing through the left nostril was 20.3 ± 15.8% while the rest of the percentage of tidal volume (70.7 ± 15.8%) passed through the right nostril (Fig. 1).



Phase II : Application of pressure to right axilla by a crutch reversed the nostril dominance and the left nostril became the dominant nostril (Fig. 1). At the end of the Phase II, the mean ±SD of the percentage of tidal volume flowing through left nostril was 74.1 ± 10.4% as compared to 20.3±15.8% at the end of Phase 1. The change started right from the first minute of the crutch application. Half of the change was evident by the second minute. The air flow through the nostrils was equalized with in 4 min. Reversal of air flow pattern through nostrils resulted in left nostril dominance thence forth. Maximal change and peak left nostril dominance occurred by 17 min. after pressure application to the right axilla by the crutch.

Phase III : Discontinuation of pressure to right axilla by removing the crutch did not lead to recovery to the initial control pattern of nostril dominance (Fig. 1). However, the effect was slightly reduced during this phase.

Statistical analysis (Table I) indicated that the changes in the percentage of tidal volume flowing through the left nostril were significant when the crutch was applied to the right axilla. The recovery was obtained for S6 & 8 when the crutch was removed; the recovery being more strong than the initial control phase in case of S6.

DISCUSSION

Rao and Potdar (4) suggested that the air flow through the right and left nostrils did not differ in the sitting position. The present investigation differed with this observation and indicated that the nostril dominance was maintained in sitting position, thus agreeing with the studies of other authors (6, 7, 8).

In the present study, the results regarding the reversal of the nostril dominance pattern by crutch application to axilla on the side of the dominant nostril agreed with similar observations by Bhole and Karambelkar (5), Rao and Potdar (4) and Davies and Eccles (6). Though reversal of nostril dominance was obtained in all of 8 subjects in the present study, the above authors (5, 6) reported that the changes failed to appear in some of their subjects.

The results in this work were comparable to the changes in the nostril air flow pattern obtained by

adopting lateral recumbent position to the side of the initially dominant nostril, as demonstrated by Mitti Mohan (2). In either physical manoeuvre the contralateral nostril was decongested. The immediate appearance of changes in the first minute and equalization of air flow through the nostrils by 4 min. due to crutch use were similar to that of lateral recumbent position. The peak change due to crutch application occurred by 17 min. while it occurred by 11 min. in the case of lateral recumbent position. In the case of crutch application the nostril dominance was reversed in all 8 subjects but reversal occurred in only 3 of the 9 subjeects with lateral recumbent position.

Earlier studies did not describe the pattern of possible recovery if any when the crutch was removed. In the present investigation removal of the crutch could not return the initial pattern of the right nostril dominance except in 2 subjects. Similarly the change in the posture from lateral recumbent position to supine position also could not result in recovery to the control pattern of the nostril air flow (2). However, the effect was reduced slightly during the recovery phase in both studies.

The present observations on the phenomenon of the nostril dominance and its reversal by the physical manoeuvre of crutch application in the axilla in the Nigerian subjects are comparable to the earlier reports (4, 5, 6) on the Indian and British subjects.

The effect of application of pressure to the axilla could not be attributed to the difference in the drainage of the nasal mucosal venous erectile tissue due to gravitational effect because the subject continued the sitting position through out the session.

It is possible that the crutch application initiated a reflex by causing stimulation of the nerve fibres in the brachial plexus, the skin, deep fascia, muscles and ligaments around the shoulder joint (4). Davies and Eccles (6) preferred to attribute the origin of such a reflex from the sensory receptors in the skin. The preganglionic sympathetic nerve fibres from the thoracolumbar spinal segments relay in the superior cervical ganglion before they are supplied to the nasal mucosal blood vessels. The erectile tissue of the nasal mucosa contracts leading to decongetion on sympathetic stimulation. Under controlled conditions the air flow through the nostrils varies between the two sides. This asymmetry is due to the variation in sympathetic tone to the venous erectile tissue in the nasal mucosa (9). Thus the sympathetic innervation to the nasal mucosal blood vessels provided the efferent part of the reflex. The central control of this reflex may be located either in the bilateral brain stem vasomotor centres (6) or hypothalamus (9).

The prolonged use of crutches by several orthopaedic patients, particularly so when they use it in only one axilla may have implications on the state of the nasal mucosa and nasal cycle. The use of a crutch like instrument 'Yoga danda' was common by Indian yogins. Descriptions on svara (3) or nostril dominance in the yogic literature tend to relate them to the flow of cosmic energy through certain channels of the body as speculated by the yogins.

REFERENCES

1. Keyser R. Die exacte Messung der Leftdurchgangigkeit der Nase. *Arch Laryngol* 1895; 3: 101-120.
2. Mitti Mohan S. Reversal of nostril dominance by posture. *J Indian Med Assoc* 1991; 89: 88-91.
3. Rai RK. (Ed) Siva Svarodaya. Text with English translation., *Prachya Prakashan*, Varanasi (India) 1980.
4. Rao S, Potdar A. Nasal air flow with body in various positions. *J Appl Physiol* 1970; 28: 162-165.
5. Bhole MV, Karambelkar PV. Significance of nostrils in breathing. *Yoga Mimamsa* 1968; 10 (4): 1-12.
6. Davies AM, Eccles R. Reciprocal changes in nasal resistance to air flow caused by pressure applied to the axilla. *Acta Otolaryngol (Stockh)* 1985; 99: 154-159.
7. Mitti Mohan S. Variations in the differential air flow through the nostrils in man with change in posture from supine to prone position. *Indian J Physiol Pharmacol* 1985; 29: 165-170.
8. Hasegawa M, Kern EB, O'Brien PC. Dynamic changes of nasal resistance. *Annal Otol* 1979; 88: 66-71.
9. Eccles R. Neurological and pharmacological considerations. In: Proctor IF and Andersen I (Ed). The nose. Upper air way physiology and the atmospheric environment. Amsterdam : Elsevier Biomedical Press. 1982; PP 191-214.