Rhinology, 23, 209-212, 1985

Nasal mucosal anaesthesia and airflow resistance

Philip Cole and James S. J. Haight, Toronto, Canada

SUMMARY

The effect of topical lidocaine solution on nasal airflow resistance was examined in five adult subjects with normal noses, seated and recumbent. The increasing use of upper airway anaesthesia in the investigation of upper airway function and the lack of published information concerning its effect on nasal airflow resistance led to this investigation. Nasal airflow resistance did not significantly change during 30 minutes observation following topical application of 4% lidocaine solution.

INTRODUCTION

The investigations reported in this paper were undertaken to determine if application of a topical anaesthetic agent (lidocaine 4%) to the nasal mucosa is accompanied by alteration of nasal airflow resistance.

Personal communications with workers in several centers has revealed interest in the effects of local anaesthesia of the upper air passages in studies of breathing disorders in sleep, respiratory load detection and alar pharyngeal dilator muscle activation (Luteren et al., 1984).

Keuning (1968) found the nasal cycle to be unaffected by local anaesthesia and our own experience with nasal catherisation has not indicated any striking effects of lidocaine on nasal airflow resistance of seated subjects. The experiments described below were undertaken with both seated and recumbent subjects in whom the effect of local application of 4% lidocaine on airflow resistance of the combined and separate nasal cavities was examined.

METHODS

Subjects

Five healthy adults (3 males, 2 females, aged 21-66) without nasal abnormality or recent symptoms of inflammation. Four of these subjects had taken part in many previous experiments and characteristics of their nasal resistances were on record.

Nasal airflow resistance

Was measured by a computer averaging technique (Cole et al., 1980) in which a head out body plethysmograph with a large laminar flow element was employed (Griffin and Zamel, 1979).

Topical anaesthesia

Each nasal cavity was sprayed 6 times from a 20 ml squeeze bottle which delivered 0.06 ml of 4% lidocaine in N saline per spray.

Experimental

a. Seated subjects. Repeated measurements (6–9) of resistance of the separate and combined nasal cavities were made during a period of 30 minutes. The nasal cavities were then sprayed with lidocaine and a similar number of measurements were continued at regular intervals for a further 30 minutes.
b. Recumbent subjects. As (a) with subjects in dorsal recumbency.

RESULTS

a and b. Seated and recumbent subjects: In seated subjects average resistance values of the combined nasal cavities before and after application of lidocaine were 1.7 and 1.6 cms H_2O/l/sec respectively and in recumbent subjects 2.5 and 2.4. Pre and post unilateral resistance averaged 6.1 and 5.2 cms H_2O/l/sec in seated subjects and 8.4 and 8.5 in recumbency. Only 7 of the 30 series of resistance measurements showed statistically significant pre and post differences ($p < 0.05$) and these were inconsistent, 2 were positive and 5 negative. When results of the 5 subjects were averaged there were no pre and post treatment differences at the 5% level of significance. Convincing evidence of consistent change was not obtained, and the order of magnitude of the differences which were found is unlikely to be an important factor in the circumstances under which topical anaesthesia is employed (Table 1).

Table 1. Mean resistance of nasal cavities in cm H_2O/l/sec $\pm$ S.D.

subject (seated) N = 6–9	combined		left		right	
	pre	post	pre	post	pre	post
1	1.6 ± 0.3	1.2 ± 0.1	2.4 ± 0.6	2.1 ± 0.4	15.4 ± 1.4	10.4 ± 1.7
2	1.8 ± 0.1	1.7 ± 0.1	3.7 ± 0.5	3.7 ± 0.3	9.4 ± 0.6	7.4 ± 0.5
3	1.3 ± 0.2	1.4 ± 0.3	2.9 ± 0.6	2.4 ± 0.2	4.6 ± 0.8	3.7 ± 0.3
4	1.6 ± 0.3	1.5 ± 0.2	4.5 ± 0.2	3.9 ± 0.2	4.3 ± 0.1	3.9 ± 0.3
5	2.1 ± 0.3	2.1 ± 0.1	9.1 ± 0.9	8.9 ± 0.5	5.6 ± 0.4	5.6 ± 0.6
(recumbent)						
1	2.3 ± 0.3	2.5 ± 0.3	2.6 ± 0.4	2.9 ± 0.3	15.9 ± 2.7	+ + + +
2	2.4 ± 0.2	2.4 ± 0.2	8.9 ± 0.7	9.7 ± 0.5	4.9 ± 0.3	4.5 ± 0.2
3	1.4 ± 0.1	1.6 ± 0.1	2.3 ± 0.4	2.5 ± 0.2	4.4 ± 0.7	3.9 ± 0.5
4	2.7 ± 0.3	2.4 ± 0.4	4.6 ± 0.3	4.2 ± 0.5	17.1 ± 1.6	15.6 ± 1.7
5*	3.5 ± 0.3	3.3 ± 0.2	10.2 ± 0.8	10.0 ± 1.2	13.3 ± 1.4	11.3 ± 1.0

* This was discontinued after 20 minutes as the patient began to cycle.

DISCUSSION

Personal communication with several investigators reveals that anaesthesia of the nasal mucosa is currently employed in experiments concerned with respiratory load detection, respiratory activity of the alar muscles, catheter studies of nasal airflow, induction of apnoeas in sleeping subjects and induced EEG changes associated with nasal breathing. The present series of experiments was performed to determine if topical lidocaine induces an increase or decrease of nasal airflow resistance, a change which might be a confounding factor in the interpretation of other effects of nasal anaesthesia.

Although a slight sensation of stuffiness is experienced by some subjects following anaesthesia of the nasal mucosa, our measurements did not demonstrate any consistent change in airflow resistance. It seems problable that stimulation of cold receptors provides an awareness of nasal airflow and this may be dulled by anaesthesia. Eccles et al. (Eccles and Jones, 1983; Burrow et al., 1983) have shown that several aromatic substances which produce a sensation of increased nasal patency do not alter nasal airflow resistance. They suggest that these substances increase sensitivity of cold receptors.

The results of our experiments indicate that changes in upper airway function following lidocaine anaesthesia of the mucosa are not caused by an airflow resistive response of the nasal mucosa to the anaesthetic agent.

RÉSUMÉ

L'effet d'une application topique de lidocaïne sur la résistance aérienne nasale a été étudiée chez 5 sujets adultes avec un nez normal, ceci en position assise et couchée. L'utelisation crossante de l'anesthésie locale dans l'investigation des voies aériennes supérieures et l'absence d'information sur ses effets ont motivé cette étude. La résistance aérienne des deux cavités narinaires, séparées ou combinées est demeurée identique à la valeur initiale durant les 30 minutes qui ont suivi l'application topique d'une solution de lidocaïne à 4%.

REFERENCES

1. Burrow A, Eccles R, Jones AS. The effects of camphor, eucalyptus and methol vapour on nasal resistance to airflow and nasal sensation. Acta Otolaryngol (Stockh) 1983; 96:157–61.
2. Cole P, Fastag O, Niinimaa V. Computer aided rhinometry. Acta Otolaryngol (Stockh) 1980; 90:139–42.
3. Eccles R, Jones AS. The effect of menthol on nasal resistance to airflow. J Laryngol Otol 1983; 97:705–9.
4. Griffin PM, Zamel N. Volume displacement body plethysmograph using a large flow meter without pressure compensation. J Appl Physiol 1979; 47:1127–30.
5. Keuning J. On the nasal cycle. Thesis, University of Leiden, 1968.
6. Luteren E van, Graaff WB van de, Parker DM et al. Nasal and laryngeal reflex responses to negative upper airway pressure. J Appl Physiol 1984; 57:746–52.

This project was funded by a generous grant from the Physicians' Services Incorporated Foundation of Ontario, Canada.

Philip Cole, M.D.
University Department of Otolaryngology
St. Michael's Hospital
30 Bond Street
Toronto, Ontario
Canada