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MAIN ARTICLE

Evaluation of the effect of nasal dorsal skin cooling on nasal mucosa by acoustic rhinometry

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Abstract

Background: The use of cold nasal packs on the nose and nape of the neck is currently recommended for patients with epistaxis as this is thought to induce reflex nasal vasoconstriction, which decreases the bleeding. There have been a few investigations on the effect of cold compress application to the nose, but none of these focused specifically on nasal cooling of the skin of the nose.

Methods: Acoustic rhinometry was performed to obtain baseline measurements. Nasal dorsal skin was then cooled with two ice packs that were held on the left and right side of the nose for a total of 10 minutes by the subjects. The rhinometry measurements were taken at the time of initial application (baseline), and after 5 and 10 minutes of ice pack application.

Results: Comparisons of the first and second minimal cross-sectional area values, and total nasal cavity volume measurements revealed no statistical differences.

Conclusion: The results of this study indicate that one should be sceptical about the efficiency of cold compress application, which is frequently used in clinical practice in cases with epistaxis.

Key words: Rhinometry, Acoustic Epistaxis; Nasal Mucosa; Regional Blood Flow

Introduction

Acoustic rhinometry is an objective procedure that allows measurement of nasal volumes and cross-sectional areas using sound waves.[1,2] It is a non-invasive procedure that requires less patient co-operation than other techniques, and can easily be performed in the office. In addition, its results are comparable with those of other objective measurements such as computed tomography, magnetic resonance imaging and rigid endoscopy.[1,3] It is used for scientific studies and in clinical practice to evaluate nasal cycle, drug reactions in the nasal cavity, disorder-related changes (e.g. nasal polyposis or septal deviations), and the effects of surgical treatment.

The use of cold nasal packs on the nose and nape of the neck is recommended for patients with epistaxis as this is thought to induce reflex nasal vasoconstriction, which decreases the bleeding. A few studies have investigated the effect of cold compress application to the nose using skin cooling on the nape of the neck,[1] and on the hands, feet, forearm[4] and whole body.[5] However, no studies have investigated the effect of direct nasal cooling of the skin of the nose.

The present study aimed to investigate the potential objective correlation between the use of a cold compress on the nose and nasal congestion measured using acoustic rhinometry.

Materials and methods

The research protocol was submitted and approved by the Kocaeli University Ethics Committee. The study was conducted in accordance with the ethical regulations of the Declaration of Helsinki, and in adherence to Turkish law and regulations.

Fifteen patients were selected after informed consent was obtained, and following confirmation of normal ENT findings. The exclusion criteria were as follows: age less than 18 years; nasal symptoms within 3 weeks prior to the examination; marked septal deviation, polyposis or infection; active allergy, asthma or systemic conditions (e.g. hypertension, diabetes mellitus, heart or thyroid disease); and pregnant patients.

The study was performed in accordance with criteria that were determined and recommended by the Standardisation Committee on Objective Assessment of the Nasal Airway in 2005.[6] All measurements were performed using an SRE2000PC acoustic rhinometer (SR Electronics ApS, Lynge, Denmark) by the same investigator. The instrument was calibrated before each measurement. All subjects were placed in

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a quiet room in which the temperature and humidity remained constant. The patients rested for 5 minutes before the test to become accustomed to the humidity and temperature. The nosepiece was positioned parallel to the nasal dorsum, and the test was performed without distorting the outer nose. The patients were asked to hold their breath and avoid swallowing while the measurements were taken.

Acoustic rhinometry was performed to obtain the baseline values. Nasal dorsal skin was then cooled using two ice packs that were held on the left and right side of the nose for a total of 10 minutes by the subjects. The rhinometry measurements were taken at the time of initial application (baseline), and after 5 and 10 minutes of ice pack application.

Acoustic data included: the first minimal cross-sectional area (i.e. minimal cross-sectional area of the nasal isthmus); the second minimal cross-sectional area (i.e. minimal cross-sectional area of the head of the inferior turbinate and cavernous body of the nasal septum); the sum of the left and right first minimal cross-sectional area; the sum of the left and right second minimal cross-sectional area; and the volume of the nasal cavity between 2 and 5 cm from the tip of the nosepiece. The data were recorded on a computer.

Differences in the parameters between measurements at 0 minutes (before cooling) and the measurements taken after 5 and 10 minutes of cooling were analysed using the paired *t*-test. All analyses were performed with the Statistical Package for the Social Sciences software, version 20.0 (SPSS; Chicago, Illinois, USA). *P* values less than 0.05 were considered statistically significant.

Results

The mean age of the subjects was 28.8 years; 9 of the individuals were female and 6 were male. All of them tolerated the procedure well, and no adverse effects from the ice packing were observed.

The mean first and second minimal cross-sectional area values, for the left and right side of the nose, at the time of the initial application (0 minutes), and at 5 and 10 minutes, are given in Table I. Comparisons of the mean values for the sum of the left and right first minimal cross-sectional area and second minimal cross-sectional area measurements (Figure 1) revealed no statistical differences, for either parameter, between: the initial measurement and the measurement at 5 minutes; the initial measurement and the measurement at 10 minutes; or the 5 and 10 minute measurements.

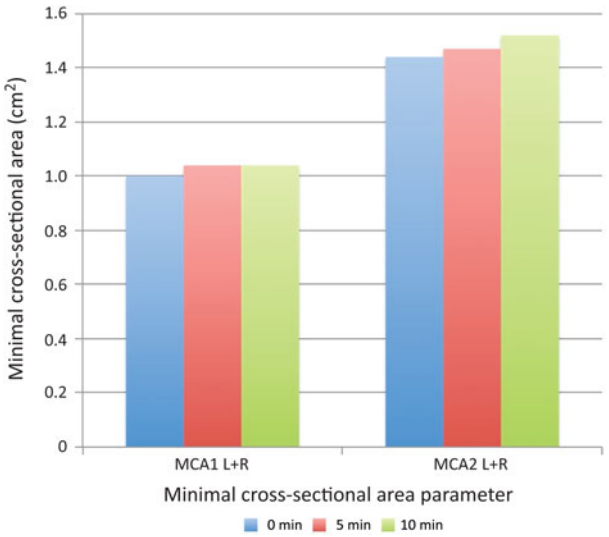

FIG. 1

Mean values of the sum of the left (L) and right (R) first minimal cross-sectional area (MCA1) measurements and second minimal cross-sectional area (MCA2) measurements. Min = minutes

The means for the left, right, and sum of the left and right nasal cavity volume measurements (between 2 and 5 cm from the tip of the nosepiece) are given in Table I. Comparisons of the mean values for nasal cavity volume (Figure 2) revealed no statistical differences, for any parameter, between: the initial measurement and the measurement at 5 minutes; the initial measurement and the measurement at 10 minutes; or the 5 and 10 minutes measurements.

Discussion

Although the application of ice packs for epistaxis is widespread, only a limited number of studies have investigated their effects on the nasal mucosa. Teymoortash *et al.* evaluated the effect of cold compress application on the blood vessels of the nasal mucosa in 56 healthy volunteers.[7] The authors found no statistically significant effect of ice pack application on the blood vessels of the nasal mucosa when values

TABLE I
MEAN FIRST AND SECOND MINIMAL CROSS-SECTIONAL AREA VALUES, AND NASAL CAVITY VOLUMES

Cold application time (min)	First minimal cross-sectional area (cm^2)			Second minimal cross-sectional area (cm^2)			Nasal cavity volume (cm^3)*		
	L	R	L + R	L	R	L + R	L	R	L + R
0	0.50	0.51	1.00	0.45	0.49	1.44	3.47	4.06	7.53
5	0.50	0.55	1.04	0.40	0.50	1.47	3.18	4.08	7.26
10	0.51	0.53	1.04	0.41	0.43	1.52	3.31	3.57	6.88

*Volume of the nasal cavity between 2 and 5 cm from the tip of the nosepiece. Min = minute; L = left; R = right

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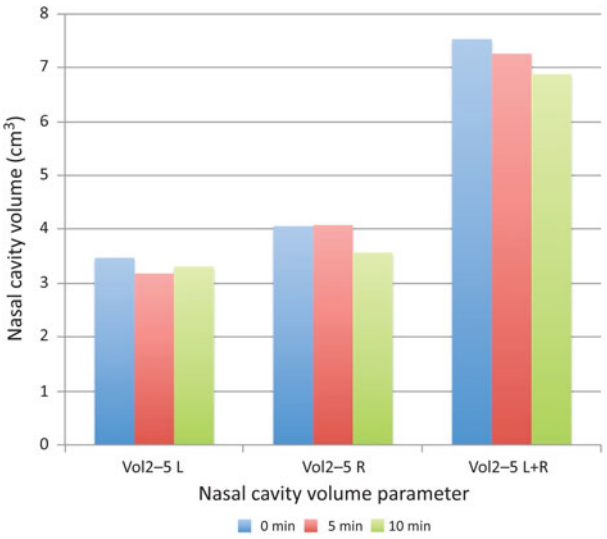

FIG. 2

Mean values of the left (L), right (R), and sum of the left and right (L + R) nasal cavity volume measurements (between 2 and 5 cm from the tip of the nosepiece) (Vol2–5). Min = minutes

for pre- and post-exposure to the cold were compared. In another study that investigated the effect of ice pack application to the neck, no effects of vasoconstriction were found in the eight healthy subjects.[1] However, Dost and Polyzoidis showed the vasoconstrictory effects of ice pack application on the nape of the neck in a study conducted in 1992.[8] That was the first study to show the effect of ice pack application on the nasal dorsum using acoustic rhinometry.

The effect of low temperature on the nasal surface has also been investigated. For instance, Chu *et al.* demonstrated that cooling prolonged the induced contraction of the nasal mucosa.[9] In addition, Watanabe *et al.* studied the effect of cold on nitroxidergic nerve-mediated vasodilatation in canine nasal mucosa. The result was the augmentation of nitric oxide release from nitroxidergic nerve endings, which aids vasodilation; thus, nasal volume decreased.[10]

A vasoconstriction response is expected in tissues upon cold application. Accordingly, cold application to the nasal dorsum is believed to aid the management of epistaxis through vasoconstriction in the nasal vessels. The present study aimed to evaluate the effects of cold application to the nasal dorsum on the nasal mucosa using an objective method, acoustic rhinometry. In the case of vasoconstriction in the nasal mucosa, there would be general decongestion in the nose, and findings indicating the enlargement of nasal volume and nasal passage would be obtained. However, there was no evidence of such decongestion and enlargement after ice pack application to the nasal dorsum, according to the measurements obtained at 5 and 10 minutes. Possible reasons for this include: insufficient cold transfer from the nasal dorsum to the nasal mucosa, temporal or physiological vasoconstriction or vasodilation caused by the cold treatment, and individual factors such as thickness of nasal dorsum and presence of chronic rhinitis. When decongestant agents are not used in acoustic rhinometry measurements, the nasal cycle results can be significantly affected. To overcome this problem, left and right side total volumes, and total values for the first and second minimal cross-sectional areas of both nasal passages, were used in this study. When one side is enlarging, the other side will shrink, and we think that using the sum of the measurements of the left and right sides will minimise the effect of nasal cycle.

- **Cold compresses are frequently applied to the nose in clinical practice in epistaxis cases, to decrease the bleeding**
- **The results of this study indicate that one should be sceptical about the efficiency of cold compress application**

Various factors can influence acoustic rhinometry. Hence, the studies using this method will take account of: an individual's emotional state, the humidity and temperature of the test room, changes in the background noise of the room, the presence of acute or chronic rhinitis, the presence of diseases that cause permanent congestion (except mucosa) in the nasal cavity (such as septal deviation), and the presence of systemic diseases that affect the vascular system or mucosa (e.g. asthma and allergy). All these factors were considered in this study, and efforts were made to provide equal conditions for the measurements. However, it may not always be possible to provide similar conditions, and the results of the study may be affected. Maximum care and high patient numbers will decrease the false measurements related to these confounders. In future studies, nasal mucosal blood flow could also be measured, to ascertain whether the manipulation actually cooled the nasal mucosa and establish whether that elicited any reduction in nasal mucosal blood flow. Alternatively, a temperature probe could be placed in the nose to see if the cooling had any internal effect on the temperature. It would be interesting to see whether an investigation conducted using these methods supported the negative findings of our study.

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