Rhinology, 29, 11-15, 1991

A comparison between the effect of ice packs on the forehead and ice cubes in the mouth on nasal submucosal temperature

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SUMMARY

The submucosal temperature in the inferior turbinate was measured in 13 subjects. It was found that giving ice cubes to suck produced a significantly greater fall in nasal temperature than did the application of ice packs to the forehead. In only seven out of the 13 subjects did an ice pack reduce nasal temperature.

INTRODUCTION

Epistaxis is a common clinical problem, and one of the time honoured first aid methods of treating it is to apply an ice pack to the face or head (Ludman, 1981; Kirchner, 1982). Although widespread, this practice is of unproven benefit (Marshall and Attia, 1986). Another first aid measure is to give the patient ice cubes to suck.

The aim of this study was to examine the physiological basis for these manoeuvres. It is based on the assumption that the temperature of the nasal mucosa reflects the blood flow through it, and thus a fall in nasal submucosal temperature reflects a fall in nasal blood flow.

The effect of cooling the body surface on nasal mucosal temperature has been well documented by several methods. Mudd et al. (1921) measured the surface temperature of the mucous membrane in response to undressing subjects and exposing them to a fan. Ralston and Kerr (1945) showed a foot-bath at 14 °C produced a fall in finger and nasal mucosal temperature. Drettner (1961) used a climate chamber cooled to 12 °C and saw a fall in nasal temperature of 1 to 2 °C. There is unpublished experimental evidence of a fall in nasal blood flow as a result of cooling the mouth in animals (Widdicombe, personal communication) but there is no experimental evidence in man.

METHOD

These experiments were performed on 13 healthy volunteers from the Royal National Throat, Nose and Ear Hospital (age 25-40, mean 30). They were

performed in an examination room with an ambient temperature between 20 °C and 25 °C.

The method of measuring nasal submucosal temperature was that of Cole (1954). A thermocouple mounted in a customised closed ended 21 SWG hypodermic needle (Edale Instruments, Cambridge) was inserted into the submucosa of the inferior turbinate. A digital meter (Edale GC202) made a continuous recording of the temperature.

All subjects were questioned to exclude a history of nasal disease or treatment and anterior rhinoscopy was performed. The subjects sat upright in an examination chair and a solution of 2% lignocaine (which is anaesthetic but not vasoactive) was applied by a cotton bud to the anterior end of the inferior turbinate on one side. After two minutes the probe was inserted. Each subject was then instructed to breath through his nose.

The protocol was as follows:

1. Insertion of probe
2. 15 minute recovery
3. 15 minute application of stimulus (a)
4. 15 minute recovery
5. 15 minute application of stimulus (b)
6. 15 minute recovery
7. 15 minute application of stimulus (c)
8. 15 minute recovery.

The three stimuli were applied in a variable order to prevent distortion of the results by habituation of the vasocontrictor response.

The three stimuli applied were:

a. An ice pack wrapped in paper towelling and held to the forehead by the patient.
b. Ice cubes sucked in the mouth.
c. (a) and (b) combined.

After insertion of the probe, readings of nasal temperature were made every minute during recovery periods and every 30 seconds whilst a stimulus was applied. The response was measured as the maximum fall in nasal temperature from the prestimulus baseline. The effect of each stimulus was compared to the other by the student t test.

RESULTS

Figure 1 shows the average fall in nasal temperature $\pm 2 \times$ standard error for each stimulus.

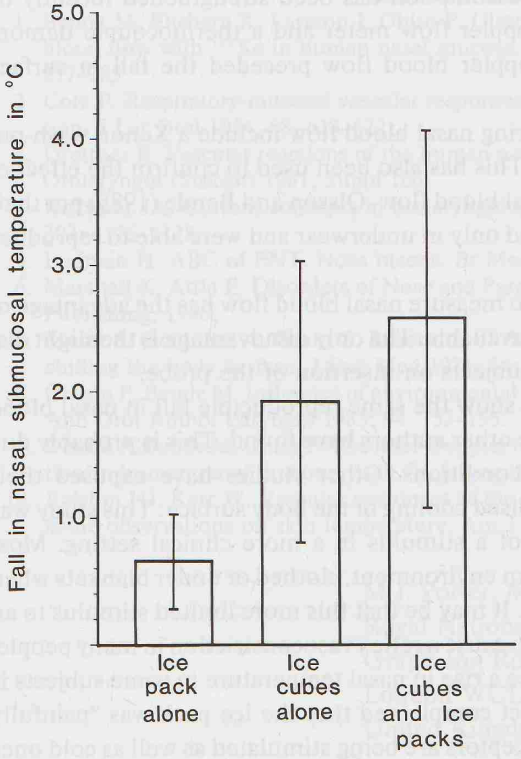

Figure 1. Average fall in nasal submucosal temperature.

When the three groups are compared there was a significant difference between the ice pack alone and the ice cubes ($p=0.026$) and also the ice pack alone and the combined stimulus ($p=0.006$). There was no significant difference between the ice cubes and the combined stimulus ($p=0.278$).

In all subjects the ice cubes produced a fall in temperature, however, the ice pack produced a fall in only seven out of 13. In three it had no effect and in three it actually produced a sustained rise in temperature!

After insertion of the probe one subject became pale, sweaty and nearly fainted. It was observed that during this period his nasal mucosal temperature fell by 5 °C and did not return to baseline until he had recovered. The response of the nasal temperature, and by implication, the vasculature was therefore similar to the cutaneous vasoconstriction seen during intense vasovagal activity.

DISCUSSION

The method used here to measure nasal mucosal blood flow by an indirect method relies on the assumption that changes in blood flow result in a change in

submucosal temperature. This assumption has been strengthened recently by Olsson (1985) using a laser Doppler flow meter and a thermocouple demonstrated that a reduction in Doppler blood flow preceded the fall in surface temperature.

Other direct methods of measuring nasal blood flow include a Xenon wash-out technique (Bende et al., 1983). This has also been used to confirm the effect of cooling the body surface on nasal blood flow. Olsson and Bende (1985) put their subjects in a room at 6 °C clothed only in underwear and were able to reproduce previous results.

The method used in this study to measure nasal blood flow has the advantage of being simple, cheap and readily available. The only disadvantage is the slight discomfort experienced by some subjects on insertion of the probe.

The results of this study do not show the same reproducible fall in nasal blood flow on cooling the skin that the other authors have found. This is probably due to the different experimental conditions. Other studies have exposed their subjects to a much more generalised cooling of the body surface. This study was designed to look at the effect of a stimulus in a more clinical setting. Most patients on the ward are in a warm environment, clothed or under blankets when an ice pack or cubes are applied. It may be that this more limited stimulus to an otherwise warm body is unable to cause a reflex vasoconstriction in many people. Why the ice pack should produce a rise in nasal temperature in some subjects is not easily explained. One subject complained that the ice pack was "painfully cold", and it may be that pain receptors are being stimulated as well as cold ones and that this accounts for the unexpected responses.

This study does show that there is a physiological basis for the practice of giving ice cubes to suck in an attempt to reduce nasal blood flow. In all subjects both the ice cubes and the combined stimulus produced a fall in nasal temperature greater than the effect of ice packs alone. Exactly where the receptors for this reflex are, and the nervous pathway, cannot be determined by this study and further work is needed.

CONCLUSION

There is a reflex vasoconstriction of the nasal vasculature as a response to cold stimulus in the mouth. Under the experimental conditions, which were intended to stimulate a clinical setting, this reflex was more consistent and more powerful than the vasoconstriction that results from forehead cooling. As a first aid measure it may prove more efficacious to give ice cubes to suck rather than an ice pack to the forehead.

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