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On the sneeze-reflex and its control*

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SUMMARY

Experiments in cats have shown that sneezing can be induced using low intensity electrical current. This study focusses on answering the question whether the sneezing-reflex can also be induced in man through electrical stimulation, whether it is reproducible, and if the response can be abolished pharmacologically? Three healthy males were tested using intranasal stimulation in different parts of the nose using a current from an electric pulse generator. Using currents in the range 2–11 mA, it was possible to induce and reproduce sneezing in the anterior portion of the nose corresponding to the distribution area of the anterior ethmoidal nerve. In one tested subject, local anaesthetics applied to the mucous membranes of the nose abolished the sneezing.

Sneeze reflex-reduction may be one way to reduce viral contamination between subjects. Further research could include pharmacological investigations to identify a sneeze-inhibiting substance with small risks for side effects that can be added to common cold nasal sprays.

Key-words: electrically-induced sneezing, pharmacological sneezing-control

INTRODUCTION

Little is known about the nose and its interaction with the nervous system. This is surprising since sneezing, for example, is an important reflex elicited from the nose. Triggering nerve fibres within the nose to induce sneezing is a most effective way for infectious agents, especially rhinoviruses, to insure that they travel long distances quickly and thereby insuring that they infect and survive in new hosts [(1)].

In experiments, sneezing has been induced in cats using several different forms of nasal stimulation: application of electrical currents to the anterior ethmoidal nerve [(2)], mechanical probing or using puffs of air [(3)], using a vibrator and by electrical stimulation to a brainstem area thought to represent a sneeze-evoking area located ponto-medullary close to the descending trigeminal nucleus and tract [(4)]. Inability to sneeze has been described in patients with Wallenberg´s syndrome (Lateral Medullary Syndrome), indicating presence of a sneeze-centre in the corresponding area in humans [(5)].

In this study we tried to answer the following questions: can sneezing be induced electrically in man as it can be in cats, is it reproducible, is the lowest trigger-level comparable between subjects, and can it be influenced by local anaesthetics?

MATERIALS AND METHODS

Test-subjects were 3 healthy males, 58 (A), 46 (B) and 37 (C) years of age, members of the local research team. They were all well informed of the nature of this research, its minimal risks for side effects and they were highly motivated to participate in the study. Six skin electrodes used as return electrodes were placed symmetrically, two on each side of the nose and two on the forehead. A lamina of silicone was placed in the nose to protect the area on the corresponding level of the interior of the nose from stimulation. An electric pulse generator (Organon DigiStim 111, Organon Technica, Durham, NC, USA) was used as a stimulator with pulse repetition rate set to the range 30-50 Hz. Stimulations were administered via an electrode (Bio-Logic TM-EcochGtrode, Biologic Systems Corp, Mundelein, IL, USA) to the mucous membrane on the lateral wall (A, B, C), both anterior and posterior to the area of the concha inferior and concha media. On the septal area, stimulations (A, C) were given inferiorly and superiorly, in anterior and posterior positions. The tip of the electrode was formed using a conductive hydrogel.

Sneezing was induced in all three subjects. The findings were reproducible after a latency period. Stimulation was presented with the electrode at rest and not when it was in motion, since moving the electrode within the nose in itself can cause sneezing. In A, the stimulation caused sneezing at 8 mA both from the lateral wall (concha inferior) and the septal wall, most clearly so from the anterior part. After spraying 10% Xylocain (lidocain, AstraZeneca) in the nose, the sneezing-response was abolished with a gradual increase of the threshold. In the second subject, (B), sneezing was induced when the electrode was

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placed on the concha inferior about 3 cm from the nares with a threshold of 2.4 mA. Doubling the current caused multiple sneezes. More posterior placement of the electrode caused a painful sensation, while a more anterior position caused the subject pain in his front teeth. In C, sneezing was induced from the middle part of the concha inferior with a threshold at 4 mA. Placement in the anterior area caused sensation from the front teeth. Stimulation of the anterior septal area caused sneezing at 11 mA. Figure 1 illustrates these findings.

DISCUSSION

Sneeze reflex-reduction can be a way to reduce viral contamination between subjects in a population. Further research should include a more precise anatomical investigation on the location and type of sneeze-triggering nerve fibres in the nose. Pharmacological research is needed to identify an effective substance that can inhibit sneezing with acceptably small risk for side effects. Such a substance might be added to common cold nasal sprays used during an upper respiratory infection. A clinical infectious study should be done to evaluate whether inhibition of sneezing in any way causes problems for the individual. The necessary research is a broad undertaking that involves many specialists in different fields of physiology and medicine and is not a two-man project.

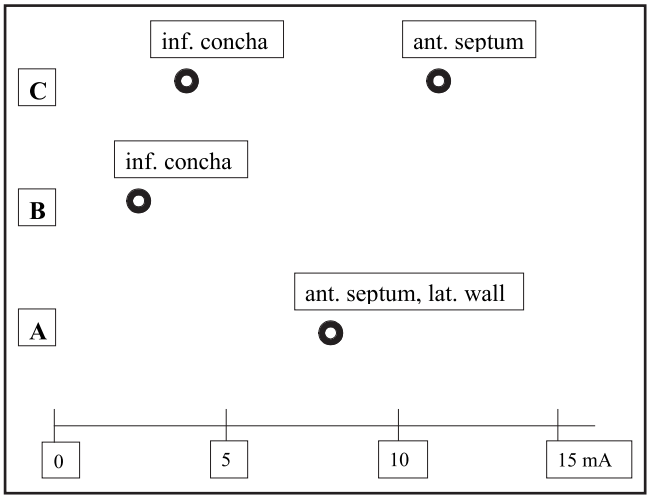

Figure. 1 Diagram illustrating the stimulus current and locations that induced sneezing in the three test subjects A, B and C.

CONCLUSION

In man, it is possible to induce and reproduce sneezing by electrical stimulation in the anterior part of the nose corresponding to the distribution area of the anterior ethmoidal nerve as has been observed in the cat. The lowest trigger-level is comparable between normal subjects. Local anaesthetic applied to the nose abolished the sneezing.

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