INDUCED VOLUME CHANGES OF THE TURBINATES

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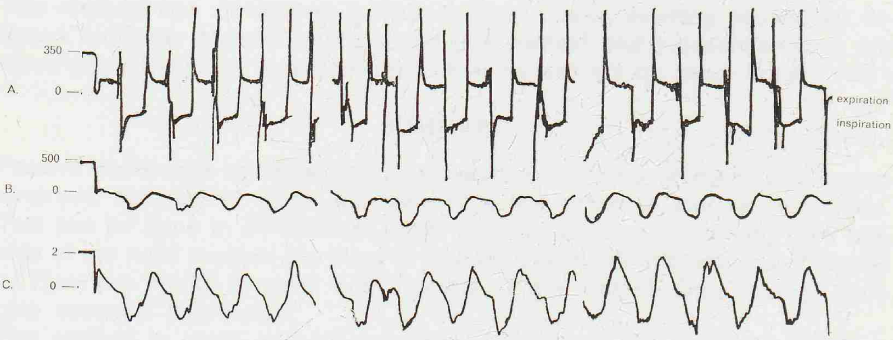
Introduction

Volume changes of the turbinates occur spontaneously during the nasal cycle, because of reflexes originating from the skin, the lung, the olfactory epithelium, the stomach, the brain etc. and from the temperature of the inhaled air. Artificially volume changes can be induced by compression of the jugular veins, by lying down on one side and by several drugs, f.i. adrenaline.

Technique

To study the induced congestion and decongestion, the nasal passability during normal quit breathing was measured by means of the conductivity meter designed by Spoor, (1965).
In this device the amount of air passing through the nose and the pharyngeal pressure needed for this, are computed electronically to a value of 100 cc^3 air by a pressure difference of 1 cm of water. The instrument indicates how



Both nose open — Left closure — Right closure

A. Conductivity $\left(\frac{ccm/sec}{cmH_2O}\right)$ B. Flow (ccm/sec) C. Pressure(cmH_2O)

Figure 1. Measuring the conductivity, flow and pharyngeal pressure during quit breathing through both nasal airways and one side. The peaks in the conductivity curve A should be disregarded.

many cubic cm of air pass through the nose on a pressure of 1 cm of water. The obvious advantage of this apparatus is that our readings are independant from the depth of breathing, that is from anxiety of the patient or in mouth-breathers from oppression.
For this kind of measurements we need two values n.l. primo the pharyngeal pressure and secundo the flow of air through the nose. If we measure one half of the nose we can use the other side for recording the pharyngeal pressure, simply by connecting this nostril to the conductivity meter. The flow is measured by the usual device in which the pressure difference on either side of an narrowing is transmitted to the conductivity meter. This means that a nozzle is held by the patient to each nostril, which he should do without disturbing the ostia interna, which is not easy.
However, if the air passage through both nose halves is the object of our study — and this is what we always should study, being the normal every day's condition — we must have a device which does not occlude one nostril and does not hamper the other one.
For this we designed a mask with two compartments which is pressed tightly on the upperlip. Thus the flow of air out of both nostrils is measured, whereas the nasopharyngeal pressure is obtained by means of a tube in the mouth. With a little explanation and exercise the patient learns to handle this mask and to avoid closing his nasopharynx or sucking on the mouth tube.

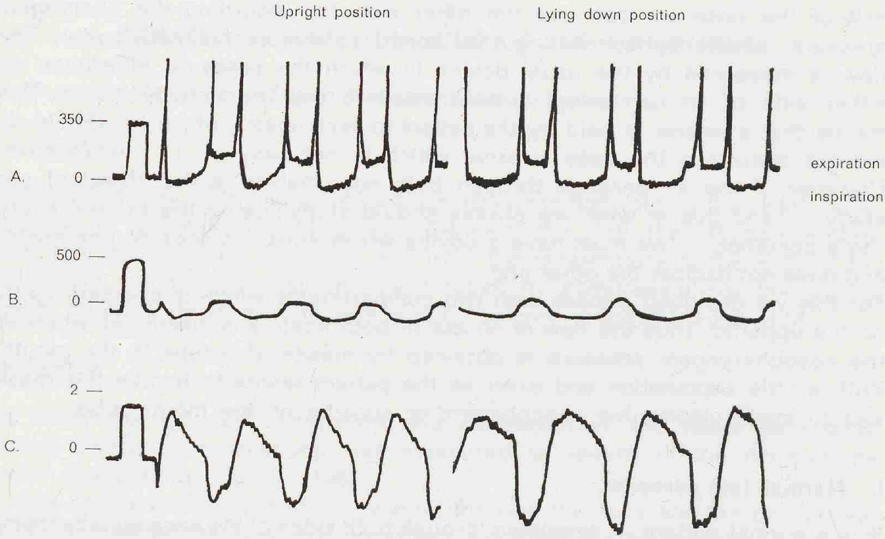
I. Normal test-persons

If in a normal patient — breathing through both sides of his nose equally freely — we measure his conductivity with both sides open and the right and left side separately, we indeed see only a slight difference.
From Figure 1 we see that the conductivity (A) in the three conditions differ very little. Only the pharyngeal pressure is a little higher while breathing through one nose half. This means that in normal conditions a human being needs only one nostril. He even will not notice if the other nostril is temporarily obstructed, as f.i. in the nasal cycle. However, if one nostril is insufficient he will notice a difficulty in nose-breathing as soon as his only competent nostril closes.

II. Comparison of the upright and the recumbent position

It appears from Figure 2 that between those fundamental positions of the human body no changes in conductivity or flow are seen. However the pharyngeal pressure is slightly higher in the recumbent position. This may be attributed to the higher blood pressure — the turbinates being on the same level as the heart. The difference in conductivity of both nose-halfs when lying on one side will be discussed in an other paper.
As it was pointed out in a previous paper (Int. Rhin. 1968) in normal persons the nasal resistance is controlled by the nasal valve (ostium internum). However as soon as the turbinates swell to such an extent that the remaining hydraulic cross-section of the airway is equal or less than the hydraulic cross-section of the valve area, the turbinates take over and control the nasal resistance and thus the conductivity.

Consequently the study of congestion and decongestion should be done in relatively narrow noses and in noses in which after dilatation by means of a speculum the ostium internum is enlarged so that the volume changes of the turbinates can be studied more readily.



A. Conductivity ($\frac{cmH_2O}{ccm/sec}$) B. Flow (ccm/sec) C. Pressure (cmH_2O)

Figure 2. Comparison of the upright and the lyingdown position.

III. Congestion by jugular vein compression

With the above mentioned considerations in mind we selected a number of test persons with relatively narrow noses caused by slight septum deviations. In some of them an one-sided slight compression of the jugular vein resulted in a marked loss of conductivity in the same nasal airway. This means that lying down on f.i. the right side may result in a congestion of the right turbinates caused by jugular compression. As van Dishoeck pointed out, already a pression of 10 cm of water is enough to cause this effect. Both-sided jugular vein compression causes a much greater congestion on both sides. For this reason tight collars and circular bandages around the neck should be avoided as they cause headache because of the congestion mentioned above.

IV. Decongestion by adrenaline

As test-person a patient with a partially obstructed nose was chosen. From Figure 3 it appears that the conductivity increases considerably after administration of adrenaline. The same holds true for the flow, which was rather low. On the contrary the pharyngeal pressure decreased as could be expected.

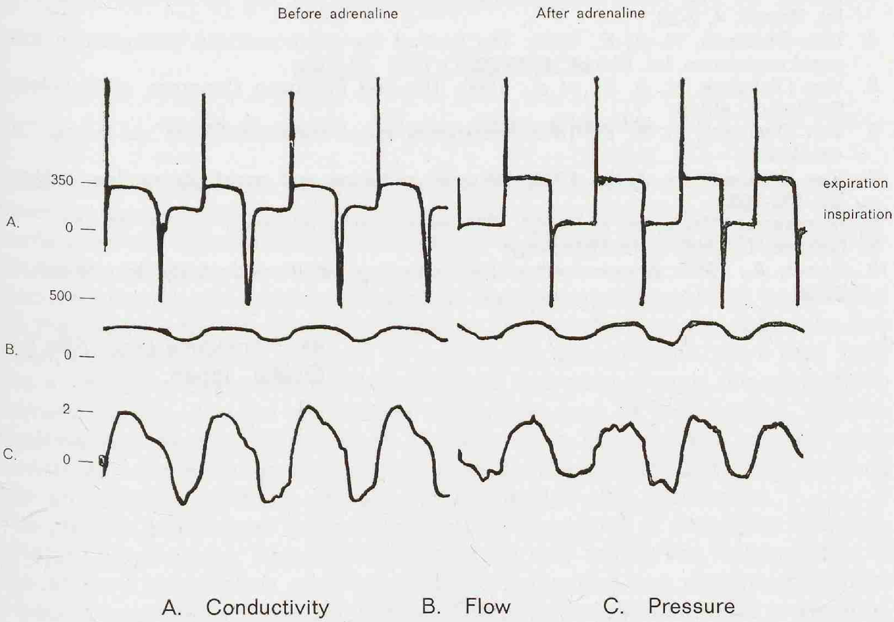


Figure 3. Effect of adrenaline on the nasal respiratory mucosa in a patient suffering from nasal obstruction.

SUMMARY

The nasal conductivity was studied in some induced changes of the volume of the turbinates, viz. closing one nostril, in the recumbent position, by slight pressure on the neck and administration of adrenaline. With the conductivity meter of Spoor these changes could be demonstrated, provided that the nasal chamber was not too wide as compaired to the valve area.

RÉSUMÉ

La conductivité nasale fut étudiée en cas de changements artificielles des cornets, c'est à dire par obstruction d'un côté, position couchée, pression légère sur une veine jugulaire et administration locale d'adrénaline.
Par moyen de l'appareil de Spoor pour mesurer la conductivité nasale et par moyen d'une masque, ces changements pourraient être demonstrées. Pour cela la chambre nasal ne devait pas être trop spacieuse en relation avec la valve nasale.

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