THE EFFECTS OF POSITION CHANGE ON NASAL PATENCY

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Introduction

Nasal patency is influenced by position change of the body in such a way that when lying on one side the lower passage of the nose is obstructed. This observation was reported as early as in 1895 by Kayser in Germany. Nasal stuffiness in the recumbent position is a wellknown experience during a common cold and is also a common complaint in patients suffering from allergic or vasomotor rhinitis. According to Vacher in France (1905) "nasal insufficiency" is often seen in children in the recumbent position because the cavernous tissue of the nasal mucosa engorges owing to gravity. It has

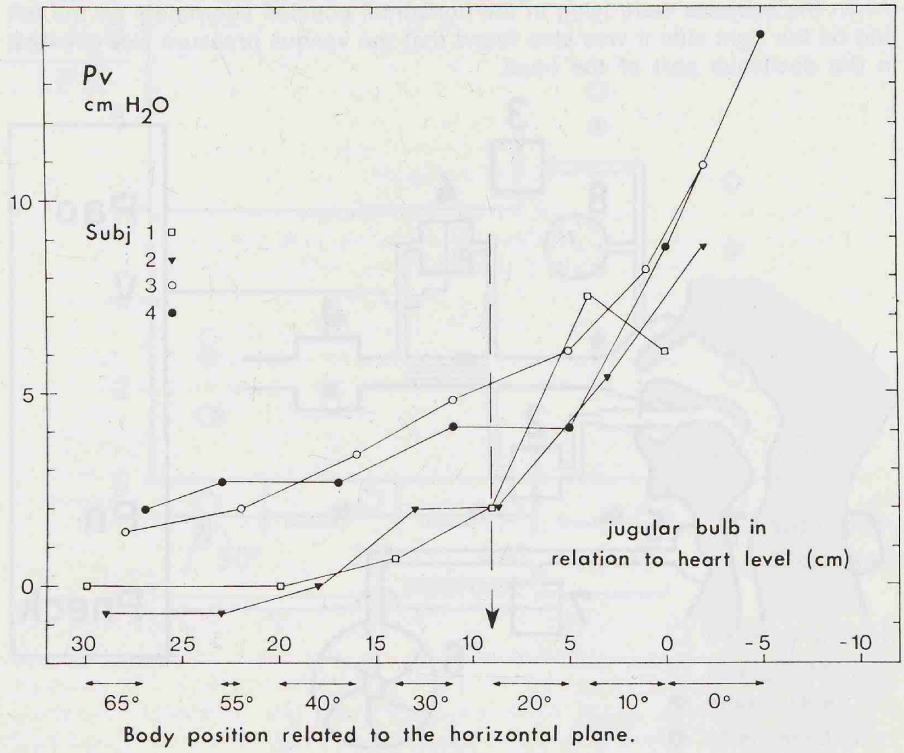

Figure 1.

also been reported that interruption of sympathetic nerve fiber impulses to the nose causes congestion of the nasal mucosa in the horizontal position. The positional influence on the nasal patency has been supposed to be connected with the hydrostatic venous pressure in the head and neck area which affects the degree of filling of the mucosal vessels of the nose.
Thus, thirty years ago van Dishoeck found that compression of the jugular vein in man was followed by an ipsilateral swelling of the nasal mucosa.

Venous pressure

In order to study the relationship between body position, venous pressure and nasal patency we have made measurements of the pressure inside the jugular vein in four healthy volunteers. A catheter was introduced via a cubital vein and the tip of the catheter was placed in the bulb of the internal jugular vein, that is at the level of the nose. The venous pressure was then recorded in several different body positions between the horizontal and the vertical (Figure 1).
In the vertical position the venous pressure is very low, just above zero. At a change of position down toward the horizontal level it was found that 20° constituted a critical angle. A change of position down to this level produced only a slight pressure increase but below it the venous pressure increased directly proportional to the level between the jugular bulb and the right atrium of the heart. The mean pressure in the recumbent position was 10.3 cm H_2O. When the subjects were lying in the horizontal position alternately on the left and on the right side it was also found that the venous pressure was greatest in the declivous part of the head.

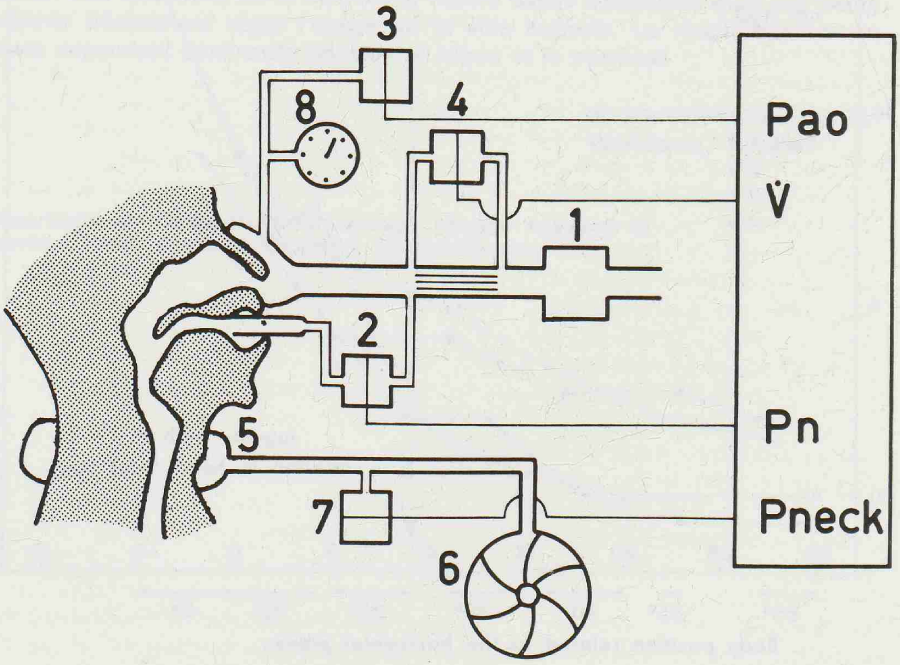

Figure 2.

In the sitting position it was possible to reproduce the same venous pressure in the bulb that prevails in the horizontal position by applying an inflatable cuff around the neck and inflate it to 35 cm H_2O.
These results were utilized in the following investigations of nasal patency.

Method and material

Four groups of patients, altogether 28 persons were studied.
1. Healthy volunteers.
2. Patients with verified but not yet treated allergic rhinitis.
3. Patients with acute infectious rhinitis.
4. The patients from group 3 one month after recovery from the infection.

The nasal airway resistance of the entire nose (Rn) was measured by means of the rhinomanometric method described by Ingelstedt & coworkers (Figure 2). This method is based upon an air flow regulator (1) which allows a pre-set constant flow of air to pass through the nasal cavities via a tight fitting nasal mask during spontaneous breathing. Gas pressure transducers recorded the pressure drop across the nose (2), the pressure inside the mask (3), the air flow, and the pressure inside the neck cuff (5). The air flow was always chosen to be 0.5 liters per second (LPS).

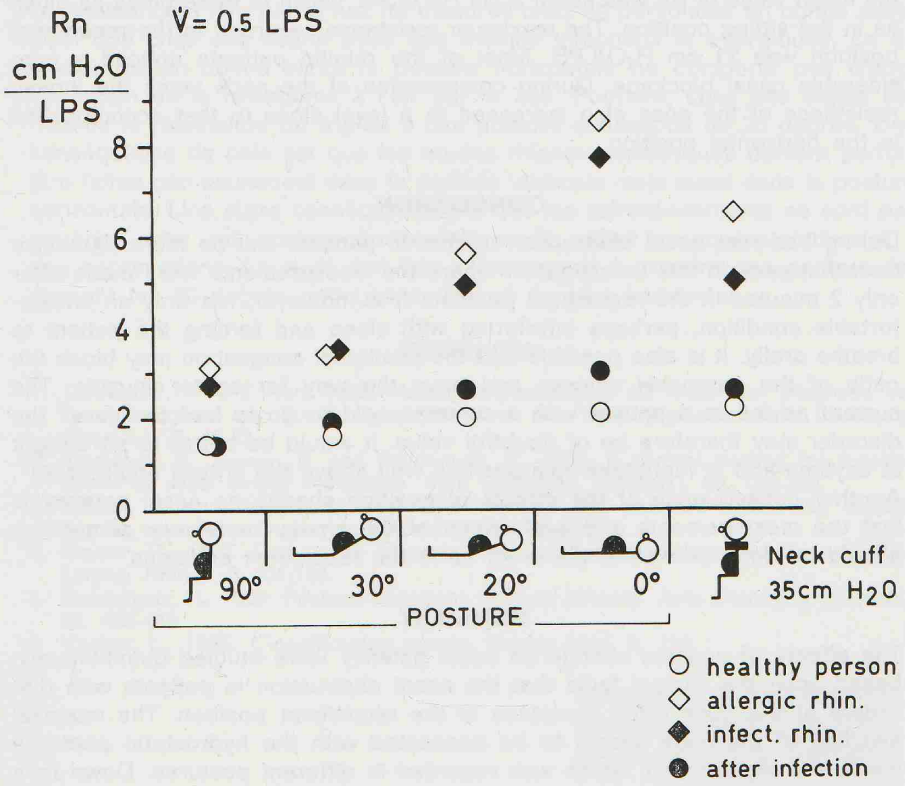

Figure 3.

Each individual was examined on two separate occasions. The subjects were placed in a folding chair and were successively placed in the same positions as were used during the measurement of venous pressures. Neck vein compression was also performed in the erect position.
The subjects were instructed to make respiratory efforts producing a pressure inside the nose mask of 5 cm of water, which they could control themselves on a mechanical manometer. Rn was measured 2 minutes after the subjects had taken up a new position or after 2 minutes'neck vein compression. After each recording the subjects were returned to the sitting position.

RESULTS

The effects of position change on nasal patency are shown in Figure 3, expressed as the mean values calculated from five consecutive inspirations and expirations. In the sitting position Rn was 1.4 cm H_2O/LPS in the two healthy groups, the corresponding values for the rhinitic patients were about twice as high. In the two healthy groups there was only a slight increase of nasal airway resistance in the horizontal position, which was not experienced by the subjects.
In the rhinitic patients, however, the resistance began to increase at the critical angle of 20° above the horizontal plane. In the horizontal position the mean value of Rn was about 8 cm H_2O/LPS, which is three times as much as in the sitting position. The maximum resistance recorded in the recumbent position was 21 cm H_2O/LPS. Most of the rhinitic patients noticed a considerable nasal blockage. During compression of the neck veins the airway resistance of the nose also increased to a level close to that accomplished in the horizontal position.

CONCLUSION

During bed rest nasal obstruction in rhinitic patients will be more extensive than that seen in this investigation where the measurements were made after only 2 minutes in the recumbent position. It is, however, not only an uncomfortable condition, perhaps interfering with sleep and forcing the patient to breathe orally. It is also possible that the positional congestion may block the ostia of the paranasal sinuses and pave the way for acute sinusitis. The current advice to a patient with a common cold to go to bed to "cure" the disorder may therefore be of doubtful value. It would be better to sit upright at daytime and at night take up a position well above the critical angle of 20°. Another consequence of the effects of position change on nasal patency is that the measurements and evaluations of the airway resistance sometimes should be done as well in the erect as in the recumbent positions.

SUMMARY

The effects of position change on nasal patency were studied quantitatively, based upon the clinical facts that the nasal obstruction in patients with disorders of the nose often increases in the recumbent position. The mucosal swelling of the nose seems to be connected with the hydrostatic pressure inside the jugular vein, which was recorded in different postures. Down to a body elevation of 20° above the horizontal plane the venous pressure is al-

most zero, below this angle the pressure increases proportionally to the difference of the level between the nose and the right atrium of the heart. In normal persons the airway resistance of the nose increases very little even in the horizontal position but in rhinitic patients the same position is followed by a considerable mucosal swelling, due to hydrostatic blood pressure increase.
The clinical consequences of the results are briefly discussed.

RÉSUMÉ

L'effet des changements de la posture du corps sur la résistance à l'air par le nez a été examiné quantitativement, examen basé sur le fait bien connu que certains symptôms en cas de maladies de la voie respiratoire s'aggravent à la posture horizontale. Par example, cela est le cas de l'enchifrênement d'un rhume ordinaire ou du rhume allergique et vasomotorique.
On a supposé que la pression hydrostatique dans la veine jugulaire interne a influencé le gonflement de la muqueuse du nez. Des mesurages de la pression dans la veine jugulaire interne dans de postures différentes ont montré que la pression était près de zéro à une posture de plus de 20 degrés audessus du plan horizontal, mais environ 10 centimètres H_2O dans la posture horizontale.
La résistance à l'air par le nez fut mesurée chez de personnes en bonne santé ainsi que chez des sujets avec des rhumes infectieux et allergiques. En de personnes en bonne santé la posture horizontale ne comporte pas d'augmentation de la résistance à l'air par le nez. Pourtant, chez des sujets enrhumés la résistance fut triplée a une posture audessous de 20 degrés. Une conséquence de cela est que les études rhinomanométriques doivent parfois être faites non seulement dans la posture verticale mais aussi dans la posture horizontale. Une autre conséquence est que les refroidissements ne sont pas «guéris» avec une posture horizontale au lit, plûtot on pourra s'attendre à des aggravations. Le sujet doit être recommandé à prendre une posture dépassant les 20 degrés critiques audessus du plan horizontal.

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