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# A nasal mask for posterior rhinometry of each side of the nose separately

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SUMMARY

*A nasal mask consisting of a frame covered with a thin latex membrane allows one nostril to be closed by the application of light pressure with a finger. When the mask is connected to a pneumotachograph it is possible to measure the resistance of each side of the nose separately by posterior rhinometry.*

Posterior rhinometry is the measurement of nasal resistance to air flow by measurement of pressure at the mouth, with lips closed round a pressure recording tube, and simultaneous measurement of air flow through the nose with a pneumotachograph (Kern, 1973). For measurement of air flow through both nostrils a nasal mask or oro-nasal mask incorporating the mouth pressure tube may be used (as supplied by Mercury Electronics (Scotland) Ltd., Pollock Castle Estate, Newton Mearns, Glasgow G77 6NU, Scotland). Measurement of the resistance of each side of the nose separately may be achieved by blocking one nostril with a plug of cotton wool and soft paraffin (Hasegawa and Kern, 1978) or by fitting an olive-shaped adaptor to the pneumotachograph and applying this to the nostril. With the former method the resistance of the two sides of the nose cannot be measured in rapid succession and the latter method has the disadvantages that (a) an additional length of narrow tube is incorporated in the breathing system, (b) the nostril is distorted and this may change the resistance at the vestibule or produce reflex effects and (c) variation in the angle between the adaptor tube and the nasal cavity may provide additional resistance.

The nasal mask described here has been designed so that one nostril can be closed by light pressure on the ala nasae without interfering with the nostril on the side being measured.

## CONSTRUCTION

The mask, which was made in the laboratory, has a frame as shown in Fig. 1. A 20 cm length of malleable metal, such as tinman's solder of D-section, approximately 6×2 mm, is bent to fit around the nose and ends soldered together to form a ring. Two lengths of brass strip about 5 mm wide and 30–40 mm long are soldered to the top and bottom of the malleable ring and to the inside of a 2 cm

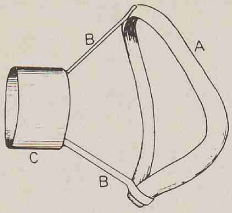


Figure 1. The frame of the mask.
A. Malleable metal ring.
B. Brass strips.
C. Brass tube.

length of 27 mm outside diameter brass tube. The frame may be coated by dipping several times into liquid latex and drying off between coats and a strip of polyurethane foam may also be applied along the surface of the ring which contacts the face. The frame is covered with a tube of thin latex rubber which may be made by dipping a 36 m diameter glass boiling-tube into liquid latex, or a condom can be used. The latter has the advantage that it is stronger and semi-transparent. The latex rubber tube is drawn over the frame and, being of a smaller diameter than the ring, the free edge is drawn inwards to form a flap which, when pressed against the face, assists in forming a seal. The other end of the latex rubber tube passes over the brass tube to which it is secured by a 5 cm length of 25 mm internal diameter rubber tube. This tube serves to attach the pneumotachograph. Excess of the latex rubber tube extending beyond the brass tube is cut away.

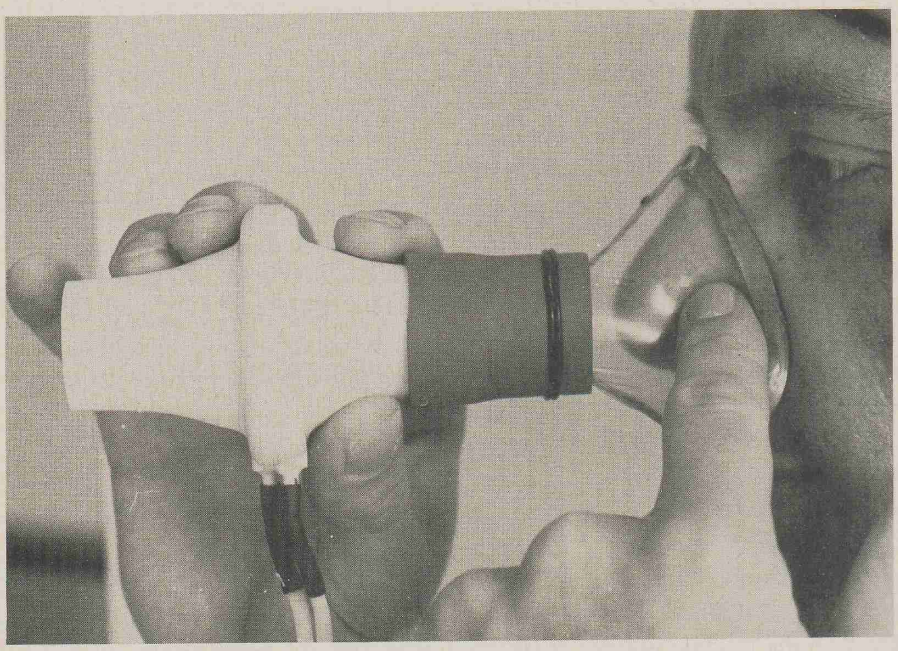

Figure 2. The mask in use.

USE

(Fig.2) The mask with pneumotachograph attached is held firmly over the nose, making sure that there is a good clearance between the nostrils and the mask, and the mouth is closed around the mouth pressure tube. The pressure inside the mask during normal or forced breathing is only a few millimeters of water and does not produce appreciable displacement of the latex rubber cover of the mask. The fit of the mask may be tested by occluding the end of the pneumotachograph and making slight expiratory efforts when the latex rubber cover of the mask will bulge outwards if there is a good fit. The resistance of each side of the nose can be measured in turn by closing the other nostril by light pressure with a finger tip, on the latex rubber cover of the mask and onto the ala nasae. The resistance to air flow of the mask is negligible and the pressure in the mask can be backed off against mouth pressure by connecting the pressure lead from the mask side of the pneumotachograph to the back of the differential gauge measuring mouth pressure. An example of measurements made with the apparatus is shown in the Table.

Table The effect of change of posture on nasal resistance.

| | Resistance (cm water/(l/sec)) | |
|---|---|---|
| Posture | Right nasal cavity | Left nasal cavity |
| Seated | 2.6 | 15.0 |
| After 10 min R lat. decubitus | 3.5 | 3.0 |
| After 10 min L lat. decubitus | 2.0 | 15.0 |
| After 10 min R lat. decubitus | 4.4 | 2.8 |

RÉSUMÉ

Un masque nasal consistant en un cadre recouvert d'une mince membrane de latex et permettant de fermer une narine en appliquant une légère pression avec un doigt a été developpé. Lorsque ce masque est connecté à un pneumotachographe il est possible de mesurer la résistance de chaque côté du nez separement par rhinometrie postérieure.

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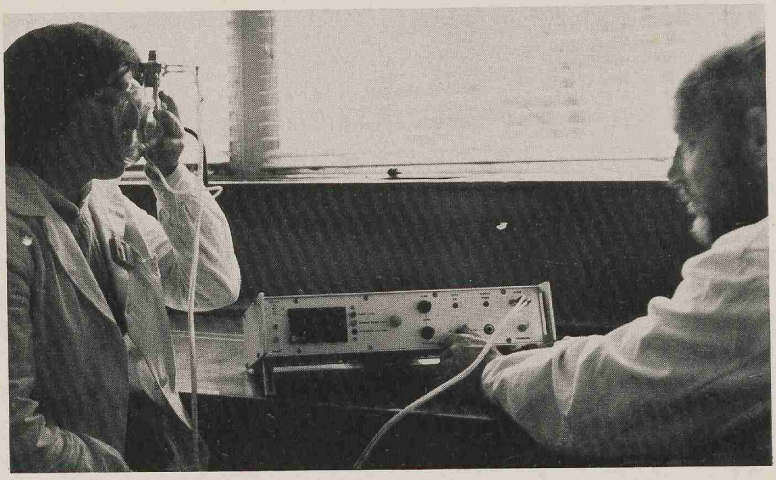
# RHINOMANOMETER



Mercury Electronics offer a range of instruments for measuring small air flows and pressures along with a number of units designed for specific specialised applications such as the posterior rhinomanometer shown above. Anterior measurements can also be made with this instrument and modifications are available to allow each nostril to be measured separately. An electronic memory circuit removes the need to have a pen recorder or oscilloscope to obtain results. For further information contact:

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# Cardiac symptoms and nasal obstruction

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It is an indisputable fact that nasal obstruction disturbs the functioning of the respiratory system and contributes to the development of pathological changes in the lower respiratory tract (Šercer, 1930; Ogura et al., 1964; Hadži-Omerović, 1965; Unno et al., 1968; Ohnishi et al., 1972; Cvetnić, 1974; Cvetnić et al., 1976; Cvetnić et al., 1978). However, it is less known that nasal obstruction may be the cause of precordial oppression and of other symptoms indicative of some heart disease (Massumi et al., 1969; Talbat and Robertson, 1973; Jackson, 1976; Krajina et al., 1977). This paper presents observations about patients with nasal obstruction and symptoms of a cardiac disease.

## PATIENTS AND METHODS

Since 1973 we have observed 293 patients in an outpatient clinic for cardiac diseases in whom nasal obstruction was the only pathological finding. These patients had been referred to cardiologists because they had complained of symptoms indicative of a heart disease. The referral diagnoses were: stenocardia, angina pectoris, arrhythmia, cardiac neurosis, vertigo or psychoneurosis.

The patients were young or middle aged persons, not older than 45 years of age. Their case histories revealed the following symptoms: thoracic pain - of a different quality than in stenocardia - which did not increase but decrease on effort; dyspnea, i.e., a feeling of a hindrance to the free ingress of air into the lungs caused by inadequate expansion of the chest. On effort instantly an unpleasant, rapid heart beat was felt. The patients often had reduced heat tolerance, some of them were prone to collapse and some felt insecure when walking or constantly dizzy. All these symptoms were more manifest in poorly ventilated rooms. The patients themselves had noticed that they were breathing through the mouth. Since the quality of pain, irradiation, duration, development and appearance of arrhythmias in ischemic heart disease are different, the coronary syndrome could be ruled out on the basis of history data alone.

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All our patients had normal clinical findings of the heart. Most of them had below-normal blood pressures, and in some cases blood pressure was elevated or oscillating.

The functional status of the myocardium was normal. ECG: the ST segment and T wave were normal in alle cases. In some patients sinus tachycardia or supraventricular extrasystoles were recorded. The heart rate did not exceed 120 per minute, but the patients often experienced a subjective feeling of having extra heart beats. The x-ray findings of the heart were normal in all patients. Arterial blood circulation was not compromised. There were no other pathological changes which could have caused the above mentioned symptoms. Only breathing through the nose was insufficient.

The patients had a complete rhinological examination. Data are presented below on 70 patients who were operated by the co-author of this paper. The remaining patients underwent surgery in other medical institutions or refused surgery of the nose.

In the group there were 39 women and 31 men aged 20 to 40 years. Thirty-two patients had subluxation and fracture of the nasal septum and 15 patients an old fracture of the nasal septum. Twenty patients had vasomotorial nonallergic rhinits with deviation of the septum and three patients collapse of the alae of the nose. Septoplasty and plastic surgery of the nasal wings were performed. Plastic surgery was completely successful in 59 patients; in 11 patients some difficulties remained, and 6 patients showed signs of postoperative vasomotor rhinitis. The operation was considered fully successful when it resulted in complete elimination of the difficulties experienced by the patient before the operation.

## DISCUSSION

In patients with nasal obstruction subjective complaints are predominant. They come to the cardiologist fearing myocardial infarction. Since they have no organic heart disease and the changes in their heart rhytm and heart rate are of the functional type, they are often considered to be neurotics.

None of the patients observed showed signs of cardiac insufficiency. However, besides these few hundreds of patients, we have also observed a few with signs of atrial fibrillation, mild cardiomegaly and pulmonary hypertonia who were suffering from severe nasal obstruction for several years. It appears presumptuous to presume a causal connection between these phenomena, i.e., to postulate that chronic nasal obstruction may cause cardiomegaly and atrial fibrillation. It is more probable that in these patients nasal obstruction and myocardiopathy was a coincidence. Further investigation would be necessary to cast more light on this problem.

How to connect nasal obstruction with cardiac symptoms?
In the cardiological literature there is no reference to this connection. Rhinologic publications have pointed to the importance of the connection between the nucleus of the n. trigeminus and the nuclei and fibers of practically all other cranial nerves as well as the first four cervical nerves and nuclei. There is also evidence of a connection between the trigeminus and vagus and the sympathetic nervous system. It is known that centers of the heart automation are imbued with the terminal branches of the vagus, and the myocardium of the ventricles with those of the sympatheticus (Cottle, 1968; Cottle, 1970).
Nasothoracic areflexia disturbs the mechanism of breathing and leads to hypoventilation. This, in turn, gives rise to the subjective feeling of being short of breath, suffering from inadequate expansion of the chest, thoracic pressure and all these symptoms are followed by fear (Šercer, 1930; Ogura et al., 1964). A disruption of the conexus between the trigeminus and vagus will be reflected by changes in the heart rhythm and heart rate.
Cardiological speaking, we have reservations about the interpretations of this dependence, to us they are new and unconfirmed ideas. Well planned experiments would be necessary to provide more evidence supporting these, so far theoretical, tenets.

## CONCLUSION

We have presented our observations about patients with nasal obstructions from the cardiologic aspect, because of their symptoms simulating those found in ischemic heart disease. Thereby we have expanded the differential diagnosis of the coronary syndrome to include another extracardial factor.
The rhinologically clearly defined role of the nose in causing disorders in heart function is very little known to cardiologists.
The experimence gained in our work with patients having nasal obstruction and cardiac symptoms has stimulated us to continue our investigation along this line.

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