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# The noncycle nose

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SUMMARY

*Approximately 600 resistance values were obtained for 50 subjects. Of the 50 subjects, 14 did not have evidence of a normal nasal cycle. These 14 subjects were selected for the study of the noncycle nose. The other 36 subjects with normal nasal cycles served as controls. By use of a mask flowmeter technique of rhinomanometry, three separate categories of noncyclicity were determined. Type 1 noncycle nose had no evidence of a nasal cycle and no fluctuation of either the right or the left side. Type 2 noncycle nose had no fluctuation of nasal resistance on one side and moderate fluctuation of nasal resistance on the opposite side. Type 3 noncycle nose had fluctuation of nasal resistance on both sides but the dominance did not reverse or change from one side to the other. This is the first study to characterize the noncycle nose and to subdivide it into three separate types using rhinomanometry.*

## INTRODUCTION

The existence of the alternating congestion and decongestion cycle of the cavernous tissue of the nasal turbinates has been observed by many workers since the turn of the century (Kayser, 1895; Lillie, 1923; Heetderks, 1927). These changes occur in approximately 80% of the population, and their existence has been confirmed by rhinomanometry (Stoksted, 1952, 1953b). The cycle varies from approximately 1 to 6 hours, and yet the exact reason for the cycle is unknown. The importance of the cycle is that the total nasal resistance to nasal breathing (binasal resistance) remains somewhat constant, while the changing volume of the erectile tissues of the two sides of the nasal chambers continues to function in a rhythmic cycle. In this way, while one side is congested and the opposite side is decongested, the person experiences no symptom of nasal airway obstruction because the total nasal airway resistance is less than either one of the individual sides (Stöksted, 1953a; Guillerm et al., 1967).

It has been suggested that the nasal cycle allows the two nasal chambers to act in unison so as to form a rheostat at the normal entrance to the airway. Keuning (1968) studied 17 men who were in their twenties and who had rhinoscopically normal noses. He found seven with regular cycles that ranged from 2 to 7 hours. He noticed that six of the men had no patency reversals or changes in dominance or reversals in the nasal cycle. He also noticed that four had irregular cycles. He reported that the total nasal conductance - the inverse of resistance - remained

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essentially constant whether regular cycles, irregular cycles, or no cycles were present. What about those patients who have no demonstrable nasal cycles? The purpose of this study was to characterize and investigate the normal subject who did not have a nasal cycle (a noncycle nose).

## MATERIAL AND METHODS

Fifty persons (32 women and 18 men) were evaluated. Two persons had been excluded because they could not relax their soft palates adequately to allow accurate measurements of transnasal pressure flow. Fourteen subjects, five men ages 22 to 50 years and nine women ages 18 to 72 years, with rhinoscopically normal nose and negative histories for nasal and paranasal sinuses showed no rhinomanometric evidence of a nasal cycle. These 14 subjects were therefore selected for the study of the noncycle nose. The other 36 subjects who had nasal cycles served as controls. Examination followed an acclimatization period of about 30 minutes; the subjects were examined while sitting and quietly breathing room air at 21°C. The relative humidity varied from 25±5% (October through April) to 35±5% (May through September).

Using the mask flowmeter technique of Mead (1960) so that pressure-flow relationships could be measured simultaneously through both nasal chambers, data were collected continuously at 15-minute intervals on each subject for approximately 7 hours.

A tight-fitting mask flowmeter was placed over the patient's face and secured with an elastic strap (Figure 1). One input into the face mask was connected to a strain-gauge gas transducer (Statham PM 270) that was open to the atmosphere. This gauge, along with two pneumotachygraph mesh screens in the mask, is used to measure nasal airflow.

A second input was used to record the pressure within the mask. This input was connected to a strain-gauge gas transducer (Statham PM 131), and the open end was connected to the mouth. This latter strain gauge, with one input in the mask and the other in the mouth, measured the transnasal pressure or pressure drop ($\Delta P$) between the mask and the nasopharynx. The transnasal pressure constitutes the driving pressure or nasal airflow. A constant bias airflow (a vacuum also could be used) was inserted in the mask to blow off or remove carbon dioxide and water vapor.

The output of the gauges entered an amplifier, and the responses could be read out on paper (Hewlett Packard Thermal Tip Recorder Model 7414A). Another output was led into an oscilloscope (Tektronix, type 564B storage oscilloscope) so that the pressure-flow relationship could be visualized on inspiration-expiration, resulting in an S-shaped curve. With this information (transnasal pressure and flow), nasal resistance was calculated, and a computerized division circuit was used to calculate the nasal resistance simultaneously from the transnasal pres-

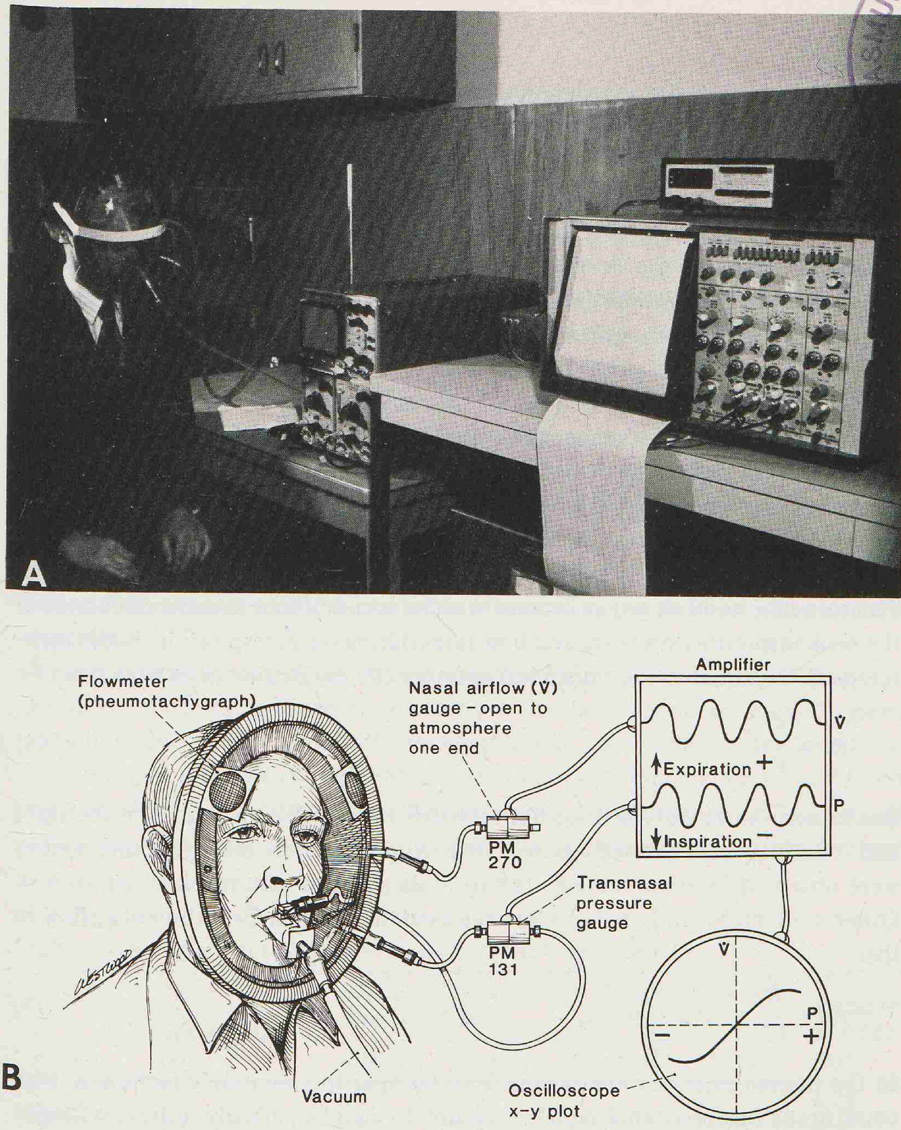


Figure 1. *A* and *B*, Investigational equipment and arrangement in active posterior rhinomanometry. A tube is placed in the mouth (not the nose) and is connected to a pressure gauge to measure the pressure difference between the nasopharynx and the atmosphere inside the mask. Another gauge is connected to the mask at one end and is open to the atmosphere at the other. With the mesh screen (flowmeter), this gauge allows measurement of transnasal airflow. The output of these gauges may be amplified and read out on recording paper. Thus, the inputs into the face mask flowmeter allow the measurement of transnasal airflow and transnasal pressure. With this information, nasal resistance can be calculated or a computerized division circuit can be used to calculate simultaneous variations in nasal resistance. Another output may be led into an oscilloscope from the amplifier so that the pressure-flow relationship may be visualized as an S-shaped curve resulting from changes during inspiration and expiration.

sure-flow curves. Only subjects who were able to relax their soft palate and breathe quietly so as to produce undistorted pressure-flow curves on the storage oscilloscope were included in the study. To avoid obstructing the mouthpiece, the subject was asked to place the tongue between the upper and lower teeth and against the buccal mucosa of the cheek. This also facilitates relaxation of the soft palate.

Data were obtained while the subject was breathing through both nostrils (binasal) and through each nostril (uninasal, right and left, by occluding the opposite side with cotton and surgical petroleum). While the subject was breathing through both nostrils, total (binasal) resistance was calculated. The uninasal (right- and left-sided) resistance was calculated with the opposite side obstructed Examinations were made every 15 minutes, and data were collected for the total nasal resistance through both nostrils and then for the right and left sides alternately. This procedure was repeated at 15-minute intervals for 7 hours, with a 1-hour break.

The value for nasal airway resistance was the mean of four breaths calculated at the peak inspiratory pressure and flow rates during quiet respiration. Nasal resistance ($Rn$) is equal to the transnasal pressure ($P$) divided by nasal flow rate ($\dot{V}$):

$$Rn = \frac{P}{\dot{V}} \qquad (1)$$

Resistance values obtained for both nostrils (total resistance) and for the right and left sides were plotted against time. Approximately 600 resistance values were obtained for each subject. The formula selected assumes laminar airflow. Other workers (Masing et al., 1974) have used the formula for turbulent airflow in that:

$$Rn = \frac{P}{\dot{V}^2} \qquad (2)$$

In the human nose, airflow ranges from laminar to completely turbulent. One could argue that resistance equals pressure divided by partially turbulent flow or that:

$$Rn = \frac{P}{\dot{V}^{1.75}} \qquad (3)$$

The laminar flow formula is the simplest and has no apparent disadvantages; and because conditions were standardized throughout the equipment, the formula allowed comparison between subjects and time. Fixed flow or fixed pressure could not be used to calculate nasal resistance. In this "physiologic" study, we recognized that not all subjects could reach a fixed flow rate of, for example, 0.5 liter/sec. The same problem exists when attemping to use a fixed pressure. It seemed more physiologic to ask the subject to breathe quietly and to calculate nasal resistance at the peaks of inspiratory pressure and inspiratory flow. Every subject had a peak pressure-flow curve during respiration. It seemed appropriate to use active rhinomanometry techniques (subject's own respiratory mechanisms) during this basic physiologic investigation. The mask flowmeter in a posterior rhinomanometric technique was employed to bypass any instrumentation that would deform the nose itself. By using posterior rhinomanometry, both nasal chambers could be examined simultaneously during physiologic conditions.

## RESULTS

The nasal cycle, defined in terms of rhinomanometry, is an alternating congestion-decongestion of the nasal turbinates sufficient to produce a change in resistance (comparing one side with the other) of 20% or more in two consecutive calculations (Hasegawa and Kern, 1977) (Figure 2). By this criterion, of the 50 subjects studied, 14 had no nasal cycle (Table 1). The other 36 subjects had evidence that substantiated the existence of a nasal cycle; these served as normal controls.

A normal control *with* a nasal cycle is shown in Figure 2 (subject 1). The nasal resistance values in centimeters of water per liter per second are plotted against time in hours. There is a definite nasal cycle with a predominant left side for almost 3 hours, after which the right side predominates. The remainder of the subjects presented in this study have noncycle nose. After detailed analysis of each one of these subjects, three separate categories of noncyclicity were determined.

Table 1. Summary of results of subjects with noncycle nose.

| Subject | Sex and age (yr) | | Right-side resistance (cm $H_2O$/L/sec | | Left-side resistance (cm $H_2O$/L/sec) | | Duration of study (hr) |
|---|---|---|---|---|---|---|---|
| | | | Highest | Lowest | Highest | Lowest | |
| 2 | M, | 26 | 13.3 | 1.8 | 5.7 | 1.3 | 6.25 |
| 4 | F, | 21 | 8.0 | 1.8 | 15.7 | 2.8 | 6.50 |
| 7 | F, | 20 | 2.5 | 1.2 | 3.3 | 1.9 | 6.75 |
| 9 | F, | 28 | 2.9 | 0.9 | 2.7 | 1.1 | 6.00 |
| 11 | F, | 18 | 6.4 | 1.7 | 6.4 | 3.3 | 5.25 |
| 13 | F, | 23 | 3.9 | 1.3 | 4.4 | 2.6 | 6.75 |
| 15 | F, | 20 | 6.1 | 1.4 | 4.7 | 1.0 | 7.00 |
| 25 | F, | 41 | 3.3 | 2.0 | 3.5 | 1.5 | 7.00 |
| 27 | F, | 72 | 3.2 | 0.6 | 8.5 | 1.9 | 7.00 |
| 36 | F, | 28 | 4.2 | 2.3 | 4.1 | 1.8 | 7.00 |
| 41 | M, | 22 | 15.0 | 2.4 | 6.2 | 2.5 | 7.00 |
| 42 | M, | 26 | 6.8 | 2.1 | 10.9 | 2.5 | 7.00 |
| 45 | M, | 23 | 5.1 | 2.3 | 11.9 | 3.5 | 7.00 |
| 47 | M, | 50 | 3.5 | 1.2 | 4.7 | 2.3 | 7.00 |

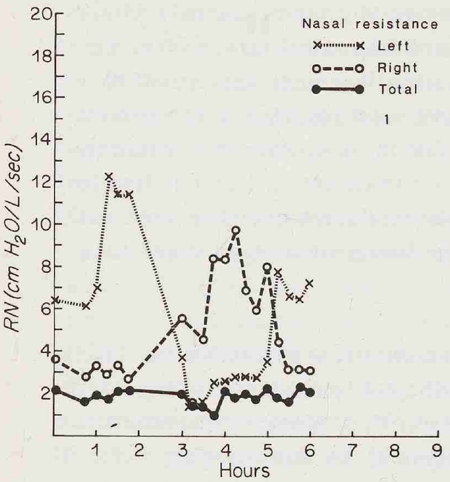


Figure 2 (control subject 1). Nasal resistance values plotted against time. Note the left-sided (x) and right-side (o) fluctuations in nasal resistance, whereas the resistance through both nostrils (total nasal resistance) remains fairly constant. Note also that the resistance differences of 20% between the two sides reversed or changed sides as the investigation proceeded. This subject had a relatively higher resistance in the left nasal airway than in the right at the start of the study. After approximately 3 hours, the situation reversed itself, and the right side had a relatively higher nasal resistance than the left side. Near the conclusion of this study, the left side again became higher than the right side, confirming the presence of a nasal cycle. Notice that the total nasal resistance remained somewhat constant and was less than the nasal resistance on either of the two individual test sides.

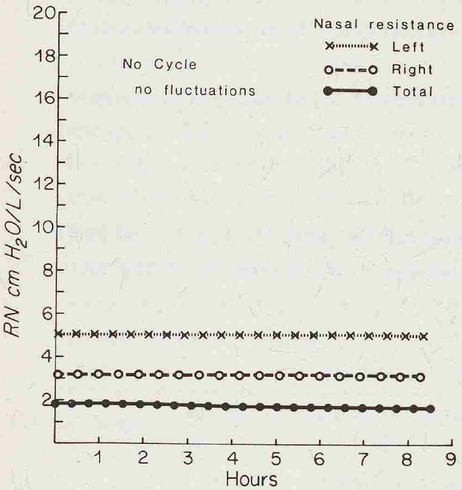


Figure 3. Schematic drawing of type 1 noncycle nose. Neither side demonstrates a fluctuation in nasal resistance.

In *type 1*, there was no evidence of a nasal cycle and neither the right nor the left side fluctuated (Figure 3). In *type 2*, there was no fluctuation of nasal resistance on one side and there was moderate fluctuation on the opposite side (Figure 4). In *type 3*, there was a fluctuation of nasal resistance on both sides which seemed to be in concert with both sides but there was no reversal or change in dominance from one side to the other; therefore, there was no evidence of a true nasal cycle (Figure 5).

The type 1 noncycle nose (in which neither side fluctuates) was seen most frequently. This was seen in 8 of the 14 subjects studied (Figure 6).

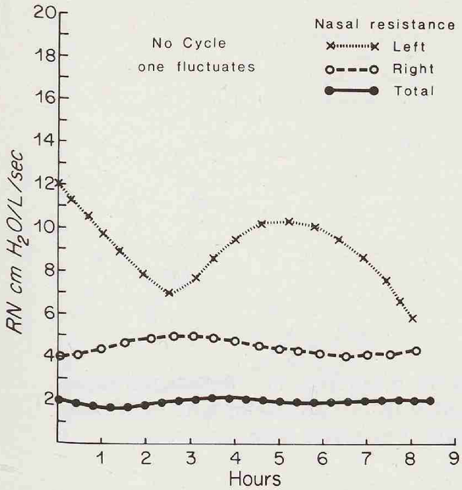


Figure 4. Schematic drawing of type 2 noncycle nose. One side demonstrates a fluctuation of nasal resistance.

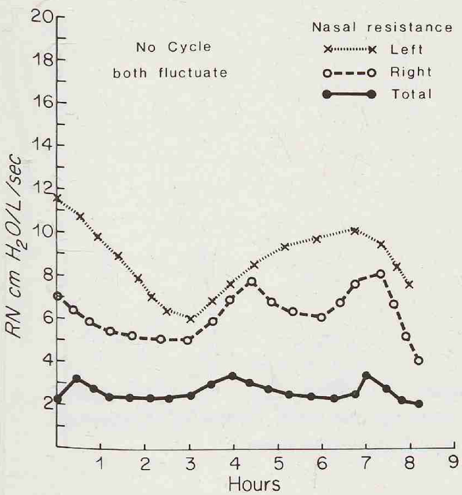


Figure 5. Schematic drawing of type 3 noncycle nose. Both sides fluctuate. Note that fluctuations seem to be in concert with each other but that dominance does not reverse from one side to the other.

The type 2 noncycle nose (in which only one side fluctuates while the opposite remains essentially stable) was seen in 2 of the 13 subjects studied (Figure 7). The type 3 noncycle nose (in which both sides fluctuate but there is no reversal of dominance) was seen in 4 of the 14 subjects studied (Figure 8).

Five control subjects had second studies. None of these demonstrated repeatable findings. The amplitude and the duration of their cyclic changes were variable. One control subject was studied on three separate occasions. On the first study, this control subject demonstrated a nasal cycle. On the second study, there was no evidence of a nasal cycle, and on the third study 1 month later, a nasal cycle was

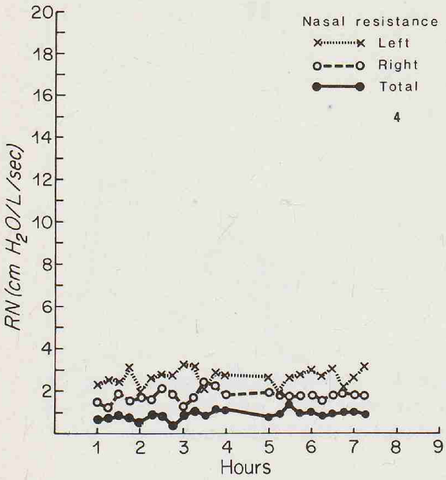


Figure 6 (subject 7). Resistance values plotted against time. This is an example of a type 1 noncycle nose.

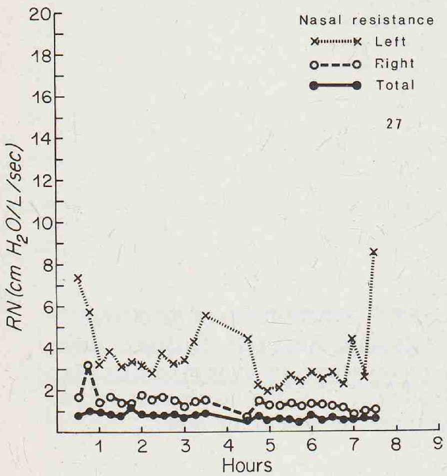


Figure 7 (subject 27). Nasal resistance plotted against time. This is an example of a type 2 noncycle nose.

again demonstrated. This control subject had an alternating congestion and decongestion of the nasal turbinates (nasal cycle) with increased resistance on the right side during the first half of the study and then a reversal of dominance with an increase in resistance on the left side during the second half of the study (Figure 9). A repeat examination demonstrated an elevated nasal resistance on the left side at the beginning of the study which persisted throughout the entire course of the study (Figure 10). Only two times during the 7-hour study did the right-sided nasal resistance increase slightly above the left-sided resistance, but since the resistance difference was not greater than 20% between the two sides

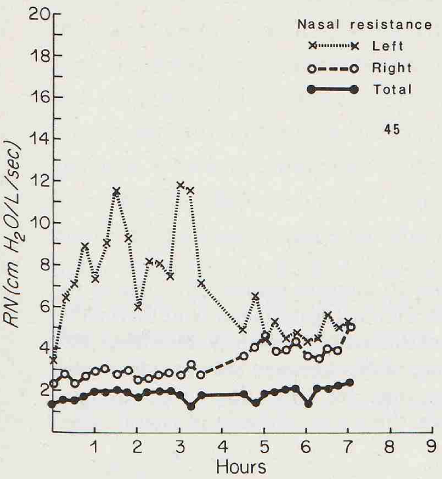


Figure 8 (subject 45). Nasal resistance plotted against time. This is an example of a type 3 noncycle nose. Note that in Figures 6, 7, and 8, there are no resistance differences, of 20% between the two sides for two successive readings; hence, there is no evidence that a nasal cycle is present in any one of these subjects.

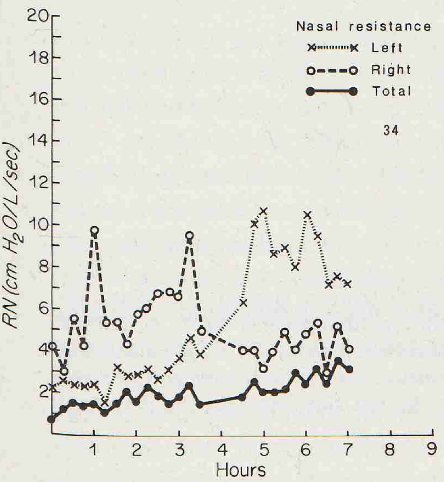


Figure 9 (control subject 34). Nasal resistance plotted against time. A definite nasal cycle is present with a predominant right side for just over several hours, and then the left side becomes the predominant side.

and this resistance difference did not persist for two consecutive calculations, then on the basis of our rhinomanometric definition, there was no evidence of a nasal cycle in this control subject during this particular study. This subject had a type 3 noncycle nose for this particular investigation on that particular day. One month later, a repeat study demonstrated the alternating congestion and decongestion of the nasal turbinates, with the resistance being greatest at the beginning of the study on the right side and then dominance switched midway through the study, when the left side predominated, reflected by an elevated nasal resistance demonstrating rhinomanometric evidence of a nasal cycle (Figure 11).

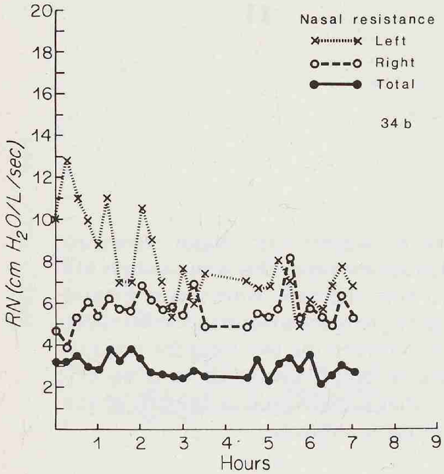


Figure 10 (control subject 34). Nasal resistance plotted against time. Note that on the day of this study, there is no resistance difference of 20% between the two sides at any given time for two successive readings. Hence, there is no evidence of a nasal cycle.

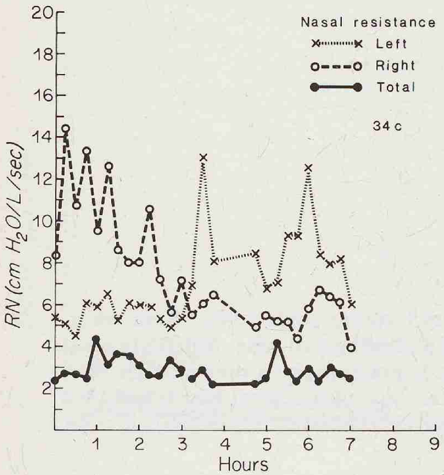


Figure 11 (control subject 34). Nasal resistance plotted against time. A definite nasal cycle is present with a right-sided predominance for just over several hours and then the left side becomes the dominant side.

DISCUSSION

Data in the present study demonstrated no nasal cycle (defined by rhinomanometric standards) in 28% of the 50 normal subjects tested. Heetderks (1927), by direct observation, found that the nasal cycle was absent in 20% of his 60 subjects studied by direct observation, although he did not characterize the noncycle nose. According to Williams (1972), Flottes and associates noted the absence of a nasal cycle in 20% of 25 persons tested. Thus, the findings in the present study are remarkably consistent with the data from these other studies. The current study is the first to characterize the noncycle nose and subdivide it into three separate types using rhinomanometry.

In 1967, Guillerm and associates studied the nasal cycle by rhinomanometry, and they were among the first, along with Stoksted (1952; 1953a, b), to relate the concept of the nasal cycle to total nasal resistance. Despite the alternating congestion and decongestion of each side, the normal person does not complain of the subjective sensation of increased nasal resistance because the total nasal airway resistance, which is lower than either one of the individual sides, remains stable. Spoor (1963, 1965) also noted that the total nasal airway resistance tended to remain constant no matter what changes occurred in the uninasal resistance. Data in the present study confirm the observation that the total nasal resistance is less than either one of the individual sides.

The nose may be considered as two resistors in parallel; thus, the total nasal resistance ($R_T$) can be calculated by dividing the product of the right- and left-sided resistances by the sum of both resistances:

$$R_T = \frac{(R_1)\,(R_2)}{R_1 + R_2} \tag{4}$$

For example, if the right-sided nasal resistance is 4 cm $H_2O$/L/sec and the left-sided resistance is 2 cm, the total nasal resistance is the product of 4 and 2, which is 8, divided by the sum of 4 and 2, which is 6; therefore, the total nasal resistance is 1.3 cm $H_2O$/L/sec, which is less than either one of the individual sides.

The finding that the total nasal airway resistance is less than either one of the individual sides leads to a speculation as to the functional role of the nasal septum. The nasal septum divides the nose into a right and left side and allows the calculation of the resistance using the concept of the parallel resistor; thus, the total resistance to breathing through both nasal chambers is less than the resistance of either one of the individual sides. Functionally, it is the total nasal airway that is most important.

Patients with a substantial unilateral airway obstruction who have had the abnormality for many years generally have learned to eliminate the problem from their conscious awareness. With a fixed nasal obstruction, such as may occur with a nasal septal deformity, the abnormal side can maintain a thoroughly constant or fixed uninasal resistance. The opposite or normal side has a variable resistance because of the fluctuations of the nasal cycle. Therefore, when the normal side is decongested, the total nasal resistance is probably within "normal limits", whereas during the congested phase of a nasal cycle, the congestion of the turbinates may become such that it increases uninasal resistance and simultaneously elevates the total nasal resistance. At that time, when the total nasal resistance is elevated above the "tolerable" or "normal" level, the patient complains of nasal obstruction on the affected side. This is curious because it is when the normal side responds to the variations in the nasal cycle that the patient becomes symptomatic hence the phenomenon of paradoxical nasal obstruction. This phenomenon has been well documented by rhinomanometric tests, serial tomography, and direct observation of the patient (Arbour and Kern, 1975).

The phenomenon of the noncycle nose with its three subtypes allows us to better understand the symptoms of nasal obstruction or the absence of nasal obstruction in patients with uninasal abnormality. The present study substantiates the concepts of elevated total nasal airway resistance and allows further comprehension of paradoxical nasal obstruction. For example, if a patient has a type 1 noncycle nose in which neither side fluctuates but has, for example, left nasal obstruction that is significant, the patient may be asymptomatic (Figure 12). One can construct a hypothetical situation in which the patient has a left nasal septal obstruction and yet remains asymptomatic because of having a noncycle nose (Figure 12). In that situation, a patient would not have an elevated total nasal resistance. If the right side were not cycling and the left side remained elevated owing to the nasal obstruction, the total nasal resistance would be less than either one of the individual sides, and the patient would be asymptomatic. With this knowledge, it is possible to understand how a patient with a left-sided nasal obstruction could be asymptomatic if he did not have a fluctuating nasal cycle, because the total nasal resistance would not be elevated. If he had a fluctuating cycle on the opposite side, he would have a paradoxical nasal obstruction (Figure 13). In this situation, the patient, for the sake of this discussion, has a left-sided nasal obstruction and complains only of mininal symptoms on the right side. This occurs because of the phenomenon of a paradoxical nasal obstruction. With a fixed uninasal obstruction on the left and a fluctuation of the nasal cycle on the right, the patient may have a type 2 or type 3 noncycle nose or may have a normal nasal cycle on the opposite side. The periodic cyclic increases in nasal resistance cause the total nasal airway

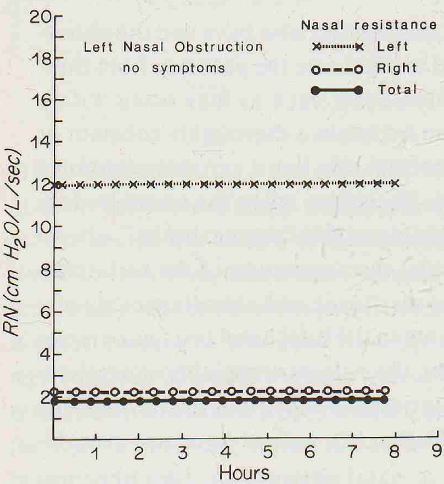


Figure 12. Theoretical plot of nasal resistance values against time for patient with left-sided nasal airway obstruction that is structural in nature and is without any nasal symptoms. Note the left-sided nasal resistance is fixed and elevated, the right-sided nasal resistance is low, and the total nasal resistance is low, below 2.5 cm $H_2O$/L/sec. Hence, this patient probably would be asymptomatic.

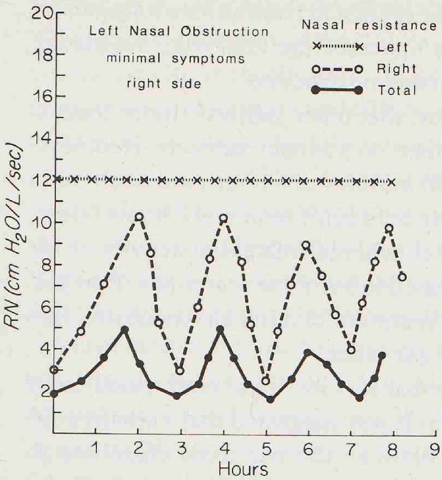


Figure 13. Theoretical plot of nasal resistance values against time for patient with left-sided fixed nasal airway obstruction. There would be minimal nasal symptoms on the right side due to the rapidly fluctuating nasal cycle on the right side, with concomitant elevations in total nasal airway resistance. The symptom of minimal nasal airway obstruction is due to the temporary increase of total nasal airway resistance above 2.5 cm $H_2O$/L/sec.

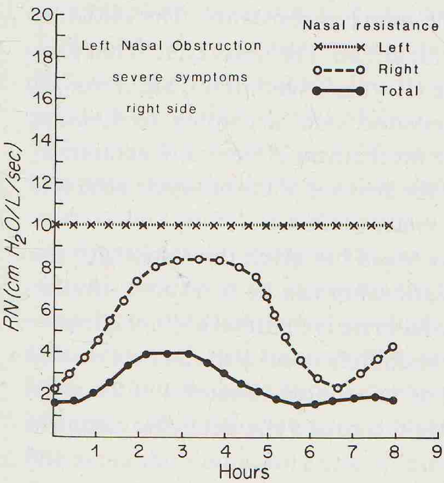


Figure 14. Theoretical plot of nasal airway resistance values against time for patient with a fixed left nasal airway obstruction and severe symptoms of nasal airway obstruction. This could be a graph for a patient with a left-sided fixed nasal airway obstruction. The resistance of the open side (right) fluctuates with the nasal cycle, and the total nasal resistance varies in concert with it. This graph may be one for a patient with a "paradoxical nasal obstruction" in that the total nasal airway resistance is elevated above a tolerable level (2.5 cm $H_2O$/L/sec), and the patient would complain of obstruction on the normal side.

resistance to become elevated and therefore produce symptoms. Usually, a *total* nasal resistance of greater than 2.5 cm $H_2O$/L/sec produces the symptom of nasal airway obstruction.

A patient may have a left-sided nasal obstruction and have severe symptoms on the right side (Figure 14 ). This is understandable if the person has a type 2 noncycle nose, a type 3 noncycle nose, or a broad normal cycle on the right side. The patient in this situation may complain of severe nasal airway obstruction because of the long duration of the increase in nasal resistance. Rather than lasting less than 1 hour, as in the previous case (Figure 13), in this situation the elevated nasal resistance on the cycling side may last 2 to 6 hours. The normal nasal cycle is reported to last from 1 to 6 hours, and when the cycle is at its peak for a long period, the elevation of unilateral nasal resistance increases the total nasal resistance, producing the symptom of severe nasal airway obstruction.

The data from the literature strongly suggest that older subjects (more than 40 years old) have a longer cycle (duration) than do younger subjects. Heetderks (1927) noted that the cycle may last from 30 minutes to 4 hours, although other workers have noted that the duration may be between 1 hour and 6 hours (Hasegawa and Kern, 1977). Heetderks speculated whether increased activity of the nasal cycle in younger subjects might be related to hormone secretions. That perhaps explains why, in certain persons, the symptom of nasal airway obstruction seems to become more disturbing as they get older.

The exact mechanism of the nasal cycle probably is no better understood today than when Kayser first described it in 1895. It was suggested that perhaps a dynamic shifting in the autonomic balance between the two nasal chambers allowed a constant change in blood flow to the erectile tissues of the turbinates and septum and thereby effectively changed the uninasal resistance. The initiating mechanism in the nasal cycle has not been identified. The nasal cycle is not present on the sympathetically denervated side (Horner's syndrome), but it may be present on the parasympathetically denervated side, according to Keuning (1968) in his report on the nasal cycle. The mechanism of the more commonly noted nasal cycle is poorly understood, and the absence of the noncycle nose also may be related to the autonomic nervous system balance.

The introduction of the mask flowmeter by Mead has given the rhinologist the equipment by which the pressure-flow relationship can be measured simultaneously through both nasal chambers. A nasal cycle is a normal physiologic phenomenon, and the absence of a nasal cycle (noncycle nose) also can be a normal physiologic phenomenon. Stoksted (1952) demonstrated variations of the nasal cycle in pathologic rhinologic conditions. He recorded a characteristic complete absence of any regular cycle in vasomotor rhinitis, and a low-amplitude curve and a diminished cycle were recorded for patients with atrophic rhinitis. The data indicate that the nasal airway is a dynamic functional organ, that there are large variations among subjects in the dynamics of the nasal cycle, and that changes in uninasal resistance do not alter the total nasal airway resistance in the normal subject. Also, there may be day-to-day variations, and on certain days, the subject may have a noncycling nose, while on other days the person is subject to wide variations in the nasal cycle. This is in contrast to the view of Principato and Ozenberger (1970), who observed that the nasal cycle was a clocklike phenomenon.

Patency or resistance of the nasal airway can be affected by many factors other than the nasal cycle. Mucosal reactions or structural abnormalities also can alter nasal airway resistance and produce the symptom of nasal obstruction. Allergic rhinitis, vasomotor reactions, nasal septal deformities, nasal polyps, and enlarged adenoids are only some of the causes of increased nasal airway resistance. Topical vasoconstrictor medications increase nasal patency, while histamines and antihistamines have antagonistic effects on nasal patency. The former drugs decrease nasal patency, while the latter drugs increase nasal patency, with the resultant increase in nasal airflow. Air temperature, humidity, posture, and psychologic factors also affect nasal resistance.

This is the first study that documents and characterizes the noncycle nose. It substantiates the fact that normal persons may have a nose that does not cycle and that the noncycle nose may be subdivided into three characteristic types: type 1, in which neither side fluctuates; type 2, in which one side fluctuates and the opposite remains stable; and type 3, in which both sides fluctuate but do not change dominance. This phenomenon of the noncycle nose and the concept of total nasal airway resistance help to better understand the findings of paradoxical nasal obstruction, in which the patient complains of nasal airway obstruction on the side opposite a fixed nasal airway obstruction. The noncycle nose phenomenon also helps explain how a patient may have a uninasal obstruction and experience no symptoms.

Reliable information concerning nasal physiology has been obtained using rhinomanometry (Solomon and Stohrer, 1965; Bridger, 1970; Bridger and Proctor, 1970; Foxen et al., 1971; Nolte and Lüder-Lühr, 1973; Hasegawa et al., 1979). However, continued investigation and development of more practical methods to study nasal respiratory physiology are required before a more complete understanding of nasal respiratory function in the normal person can be achieved. The present work helps better define the normal nose and allows for a better understanding of the asymptomatic patient with a significant uninasal airway obstruction. This work also allows further speculation as to the physiologic role of the nasal septum, because, functionally, total nasal airway resistance to breathing air through both nasal chambers is most important.

## RÉSUMÉ

Environ 600 valeurs de résistance ont été obtenues chez 50 sujets. De ces 50 sujets, 14 ne montraient pas de cycle nasal normal. Ces 14 sujets ont été sélectionnés pour l'étude de nez non-cyclique. Les autres 36 sujets à cycles nasaux normaux ont servi de groupe de contrôle.

Par une méthode rhinomanométrique basée sur une technique de mesure de flux d'air avec masque, trois catégories différentes de non-cyclicité ont été déterminées.

Le type 1 de nez non-cyclique ne montrait pas de cycle nasal et pas de fluctuation, ni à droite, ni à gauche.

Le type 2 de nez non-cyclique ne montrait pas de fluctuation se résistance nasale d'un côté et montrait des fluctuations modérées de résistance nasale de l'autre côté.

Le type 3 de nez non-cyclique montrait des fluctuations de résistance nasale des deux côtés, mais la résistance dominante ne tournait pas ou ne changeait pas d'un côté à l'autre. La présente étude est la première à caractériser le nez non-cyclique et à le subdiviser en trois types différents en utilisant la rhinomanométrie.

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