

The importance of nasal airway resistance and nasal symptoms in the selection of patients for septoplasty

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SUMMARY

The postoperative symptoms and subjective improvement of 100 patients who had undergone functional septoplasty were compared with the change of unilateral nasal airway resistance (NAR). Before the operation, the NAR after decongestion of all these 100 patients was higher than normal. 81 were subjectively improved - whereas 94 had improved according to rhinomanometry. 74 percent of those who were subjectively improved obtained a normal NAR thanks to the operation. Among the remaining 19 patients, 37% ended up with normal NAR, too.

The preoperative symptoms of those 100 patients were compared to the symptoms of 100 non-operated subjects who suffered from nasal stuffiness but whose NAR was normal. The patients whose NAR was higher than normal had more often unilateral nasal stuffiness, and a larger number of them were able to remember a nasal trauma. Still, almost 15 patients with high NAR did not recall a trauma, nor did they suffer from unilateral stuffiness.

The conclusion is that rhinomanometry is necessary in the selection of patients for septal surgery.

INTRODUCTION

The indications for surgery of the nasal septum are usually based on the history of the patient and on the rhinoscopic findings. An objective way of evaluating nasal airway resistance (NAR), i.e. rhinomanometry, has mainly been used in order to control the operative results.

Physical exercise gives a marked decongestion of the nasal mucosa. Rhinomanometry a short time after exercise thus gives a measure of the NAR caused mainly by cartilage and bone (Broms, 1982). As these are the structures that are corrected in septal surgery, rhinomanometry after decongestion ought to be a suitable method when selecting patients for surgery.

The aims of the present investigation have been to evaluate:

1. whether rhinomanometry is suitable for selecting patients who can be operated on with good results;
2. whether a carefully compiled patient history makes rhinomanometry superfluous.

MATERIAL AND METHODS

The material consisted of 200 patients who came to our ENT-department to be treated for nasal stuffiness. In all of them, a non-mucosal obstruction was suspected; therefore, rhinomanometry was performed. One hundred of the patients (19 women and 81 men, aged 15–61, mean age 31) showed a higher unilateral NAR after decongestion than the value that is normal according to Broms (1982). These patients subsequently underwent surgery. The other 100 patients (29 women and 71 men, aged 17–59, mean age 32), who served as a control group, had normal NAR and were not operated on.

The rhinoscopic aspects were not evaluated here, mainly because all the patients included in this study were estimated to have more or less marked septal deviations.

Rhinomanometry

Anterior rhinomanometry during spontaneous breathing was performed immediately after physical exercise. Pressure-flow curves for both nasal cavities were recorded X-Y-wise on an oscilloscope. NAR was calculated at the "circle 2" with a radius corresponding to 2 cm H₂O (which almost equals 200 Pa) and 0.2 l/sec (= 200 ccm/sec) on the two axes respectively, according to Broms et al. (1982a). Where the statistical evaluation was concerned NAR was expressed as an angle ν_2 . The relevant clinical parameter R_2 (Pa/ccm/sec) can easily be calculated on the basis of the ν_2 angle ($R_2 = \tan \nu_2$ (sin or dx)).

All the patients were measured with rhinomanometry once. Those whose rhinomanometric values were high were measured again some three weeks later. Only the first rhinomanometric values were used in the statistic evaluation. The patients who underwent an operation were measured during a period from six to twelve months after surgery.

Questionnaires

At the time of the first rhinomanometric test, all patients filled in a questionnaire. The queries they were asked to answer dealt with such matters as the type and duration of nasal obstruction, nasal secretion, sneezing, nasal trauma in the patient's history, and so forth.

Postoperatively, in connection with the rhinomanometry, a new questionnaire was issued to the patients. This time they were asked to state whether they felt

better after surgery – in other words, whether they were “subjectively improved” – and to say whether nasal stuffiness, nasal secretion and/or sneezing still bothered them.

Operative procedure

The 100 patients were operated on while under general anaesthesia, according to the principles of functional septoplasty supplied by Masing in Theissings “Kurze HNO Operationslehre”. Almost all the operations took place under the supervision of one of the authors.

Statistics

Groups of v_2 values were given as mean \pm SD of the mean value. Student's t-test was used for comparison. Differences in the answers from the questionnaires were estimated by means of the χ^2 -test. The following values for significances were used:

$p \leq 0.05$ tendency⁺

$p \leq 0.01$ significance⁺⁺

$p \leq 0.001$ high significance⁺⁺⁺

RESULTS

Rhinomanometric evaluation

In the 100 patients who underwent surgery, the NAR of the narrower cavity was lower after the operation than it had been before. The difference was highly significant. The mean values \pm SD of v_2 are given in Table 1, where the values pertaining to the wider cavity and the total nose can also be studied. The corresponding mean values of R_2 are supplied in the Table, too. In some of the patients, the postoperatively narrower cavity was not the one which had been narrower before the operation. Where these patients were concerned, the values of the other and now narrower side were hence used as postoperative results in the Table. A demonstration of the way in which the operation changed the NAR of the preoperatively narrower cavity in each individual case is provided by Figure 1. The number of dots above the line of identity indicates that the NAR increased after the operation in 6 patients only. In 3 of these patients, the preoperatively nar-

Table 1. Mean pre- and postoperative NAR (R_2 in Pa/ccm/sec) and corresponding mean values \pm SD for v_2 .

	preoperative		postoperative	
	R_2	v_2	R_2	v_2
narrower cavity	1.38	$54.1^\circ \pm 17.0^\circ$	0.47	$25.3^\circ \pm 15.2^\circ$
wider cavity	0.33	$18.2^\circ \pm 13.1^\circ$	0.26	$14.3^\circ \pm 5.9^\circ$
total nose	0.25	$27.5^\circ \pm 13.6^\circ$	0.16	$18.1^\circ \pm 8.4^\circ$

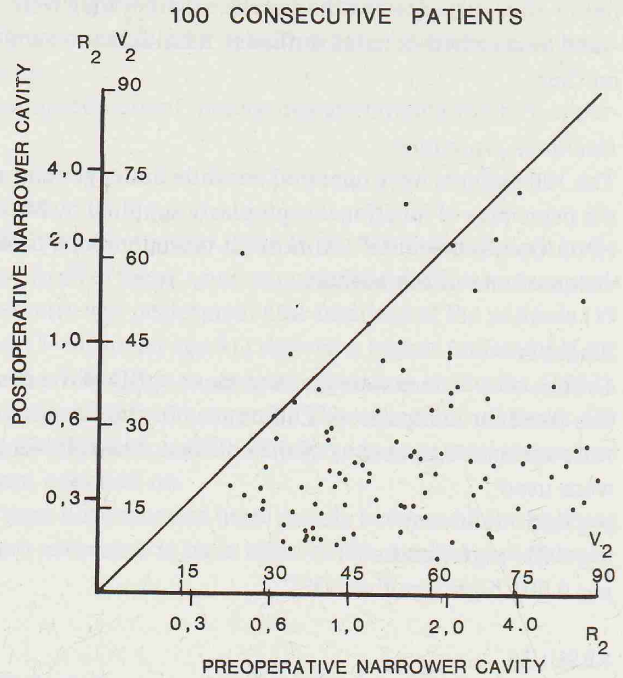


Figure 1.
Pre- and postoperative v_2 and R_2 values of narrower cavities. Dots above the line of identity show patients with increased NAR postoperatively.

rower cavity ended up with an increased NAR; in the other 3 patients the increase occurred in the wider side.

As the operation did not entail a septum perforation for any one of the patients involved, it was possible to perform anterior rhinomanometry in all of them.

Analysis of questionnaires

An analysis of the 100 postoperative questionnaires showed that 81 patients felt that their nasal breathing had improved. Nineteen patients did not register any improvement. Seven of the 19 patients even felt that their nose breathing had gone from bad to worse.

The v_2 value of those 81 patients who were subjectively improved was $24^\circ \pm 15^\circ$ on their narrower side. In the case of the 19 patients who did not record any subjective improvement, the same value was $32^\circ \pm 16^\circ$. The reductions from the preoperative values were significant; with regard to the subjectively improved patients $p < 0.001$, and in the case of the others $p < 0.05$.

For 76 of the 81 satisfied patients (94%) the operation meant that the NAR decreased; in fact 56 (72%) of them developed a normal NAR value on their narrower side. Eighteen of the 19 unsatisfied patients had a lower NAR after the operation (95%), and 7 (37%) obtained normal NAR values. According to the χ^2 -test, more satisfied patients than unsatisfied ones were associated with a normal NAR

($p < 0.05$). In 31 (38%) of the 81 satisfied patients, the v_2 values of the wider cavity increased as a result of the operation. Among the 19 unsatisfied ones, 11 (58%) obtained an increased NAR on their wider side. The difference was not significant ($0.1 > p > 0.05$). Although 81 patients were subjectively improved after the operation, 26 of these patients were still bothered by a feeling of nasal stuffiness. Among the 19 patients who did not improve subjectively, as many as 18 reported the same symptom. After the operation, 22% of the 81 patients had problems with nasal hypersecretion and 17% with incrustations. Among the unsatisfied patients, the figures were 47% and 37% respectively. As was stated above, 6 patients had increased NAR after the operation. Five of these 6 patients were subjectively im-

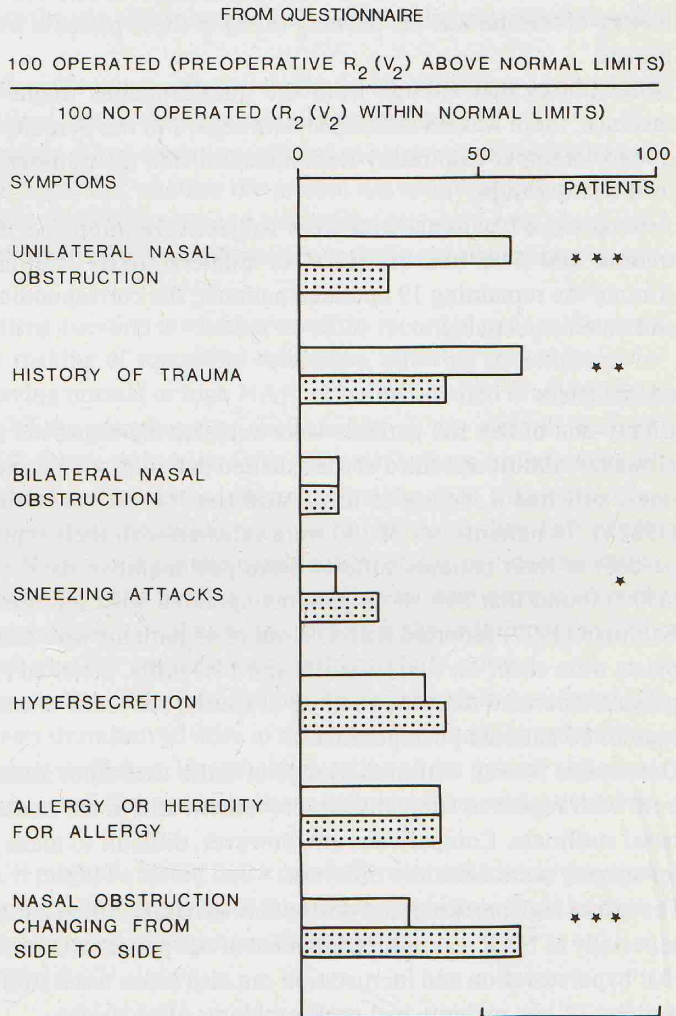


Figure 2. Comparison of symptoms between patients with pathological NAR and normal NAR.

proved by the operation.

An analysis of the questionnaires, both from the 100 non-operated (with normal NAR) and the 100 operated patients (with high NAR), showed that the latter, unlike those patients who did not undergo surgery, more often had a feeling of a unilateral nasal obstruction; the difference was significant (Figure 2). The non-operated patients more often had nasal stuffiness changing from one side to the other. The operated patients were more frequently able to recall a trauma against their nose; again, the difference was significant. The number of operated patients who had a history of trauma as well as unilateral or bilateral nasal stuffiness was 42. Thirty-six (86%) of these patients were subjectively improved after the operation. The number of patients who had *either* unilateral or bilateral nasal stuffiness *or* a history of trauma was 86. Seventy (81%) of these patients were subjectively improved.

Other points that emerge from the questionnaires might be mentioned; for instance, there was no difference with regard to the heredity for allergy, the frequency of upper-respiratory-tract infection, and the number of tobacco smokers in the two groups.

Among the 81 patients who were subjectively improved, 62% remembered a trauma and 54% had unilateral or bilateral nasal stuffiness preoperatively. Among the remaining 19 operated patients, the corresponding figures were 63% and 58% respectively.

DISCUSSION

Eighty-one of the 100 patients were subjectively improved by the septoplasty. However, almost one third of the satisfied patients, and nearly all the unsatisfied ones, still had a feeling of nasal stuffiness (44%). According to Broms et al. (1982b), 74 patients out of 100 were satisfied with their septoplasty. Forty-four percent of their patients suffered from postoperative nasal stuffiness. Feenstra (1972) found that 80% of 50 patients operated with septoplasty were satisfied. Sherman (1977) reported that 82% out of 49 patients who had undergone septoplasty were clear, 4% slightly stuffy and 14% stuffy. Stoksted (1969) followed 100 patients operated after the method of Cottle. He found a satisfactory nasal passage in 86 patients postoperatively.

Our results fit well within the range of those that other authors have obtained, both with regard to subjective improvement and in the matter of postoperative nasal stuffiness. Comparisons are, however, difficult to make, as the indications for surgery were certainly different.

The rather high percentage of postoperative nasal stuffiness may seem surprising, especially as NAR was reduced in most of our patients. One likely explanation is that hypersecretion and incrustation can also cause nasal stuffiness; quite a large number of our patients had such problems after surgery.

A significantly higher percentage of subjectively improved patients attained normal NAR in their narrower cavity as compared to the unsatisfied patients. Furthermore, the postoperative mean NAR of the satisfied patients was lower and more reduced than that of the unsatisfied ones. Thus, a correlation between subjective and objective improvement would appear to exist. Feenstra (1972) and Broms et al. (1982b) also found such a correlation after septoplasty.

The connection between nasal stuffiness and NAR in 1000 unoperated patients was studied by McCaffrey and Kern (1978). They found a positive correlation between the degree of nasal "obstruction" and NAR, both with regard to the separate cavities and the total nose. This correlation, and the one that we - and other authors - have found to exist between subjective improvement and reduced NAR, ought to validate the use of rhinomanometry in selecting patients for septal surgery.

The question is whether the most common methods, i.e. rhinoscopy and taking the history of the patient, make rhinomanometry unnecessary.

In most patients, though, a septal deviation is found to exist regardless of whether the NAR is normal or high, and whether the patient has symptoms or not. Stoksted (1956) and Masing (1977) mentioned that there can even be a great disproportion between the rhinoscopy and the patient's feeling about the air passage in his nose.

A rather more interesting question is whether carefully recorded patient histories are conducive to the making of successful selections, allowing investigators to classify patients as having normal or high NAR, or being satisfied or unsatisfied patients. An analysis of the questionnaire answered by all our patients showed that those whose NAR values were high were more apt to have unilateral nasal stuffiness, and to be able to remember a trauma against the nose, than those whose NAR was normal. In spite of the differences we found, more than half of the patients with high NAR did not have the combination of uni- or bilateral stuffiness and trauma. Nearly 15% had neither uni- or bilateral stuffiness or trauma. Conversely, too many patients would undergo surgery if the criterion was stuffiness only; after all, all our 200 patients suffered from stuffy noses.

There was no difference between the group of subjectively improved patients and the group of subjectively unimproved ones in respect to the frequency of trauma and uni- or bilateral nasal stuffiness. Hence, the question about trauma and nasal stuffiness cannot yield a prediction as to whether a patient will be subjectively improved or not.

By way of conclusion, it might be stated that a carefully recorded history does not form a sufficient basis for selecting patients. Such a patient history must be complemented by rhinomanometry after proper decongestion.

ZUSAMMENFASSUNG

In der vorliegenden Untersuchung wurden zwei Vergleiche angestellt. Erstens wurden die postoperativen Symptome und die subjektive Besserung mit der Veränderung der einseitigen Atemwiderstandes durch die Nase (NAR = nasal airway resistance) an 100 Patienten verglichen, die mit funktioneller Septumplastik operiert worden waren. Sämtliche diese 100 Patienten hatten nach Abschwellung NAR-Werte die über dem Normalen lagen. 81% gaben eine subjektive Besserung an und 94% waren rhinomanometrisch gebessert. Von den subjektiv gebesserten zeigten 84% und von den restlichen 19 Patienten 37% eine Normalisierung des NAR-Wertes nach der Operation.

Zweitens wurden die subjektiven Symptome dieser 100 Patienten mit denen bei 100 nicht-operierten Patienten verglichen, die eine verringerte Nasendurchgängigkeit aber normale NAR-Werte aufwiesen. Patienten mit übernormalen NAR-Werten wiesen öfter eine unilaterale verringerte Nasendurchgängigkeit auf und erinnerten sich öfter an Traumata gegen die Nase. Fast 15% der Patienten mit hohen NAR-Werten hatten jedoch weder eine verringerte Nasendurchgängigkeit oder konnten sich eines Trauma entsinnen.

Aus den beiden Vergleichen wird die Notwendigkeit einer Rhinomanometrie bei der Auswahl von Patienten für Nasenscheidewandchirurgie geschlussfolgert.

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