ORIGINAL CONTRIBUTION

Rhinology, 47, 24-27, 2009

What happens to patients with nasal stuffiness and pathological rhinomanometry left without surgery?*

Helle L. Thulesius, Hans O. Thulesius, Max Jessen

ENT-Department, Central Hospital, Växjö, Sweden

SUMMARY

In this study we explored long term outcomes of patients with nasal stuffiness and high nasal airway resistance (NAR) that did not undergo nasal surgery. The same investigation was repeated on average 8 years after a baseline investigation with an ENT-examination, a rhinomanometric survey and a rhinomanometry. We did follow-up investigations in 44 out of 59 non-operated patients with a pathological NAR on at least one side. At follow-up 2 persons (4%) had no complaints, 14 (32%) had reduced, 22 (50%) unchanged, and 6 (14%) increased complaints of nasal stuffiness. Rhinomanometry showed that NAR values decreased significantly between baseline and follow-up on both wider and narrower sides after decongestion. There was no correlation between subjective nasal complaints and NAR-values. In logistic regression models increasing age and allergy prevalence at baseline were significantly associated with having no, or reduced nasal stuffiness at follow-up. The results show that both NAR and subjective nasal stuffiness decreased with age. Consequently, we suggest that NAR normal values should be age adjusted. Also, a wait and see policy towards nasal stuffiness seems relevant since 36% of our patients had no or reduced nasal stuffiness while their NAR-values were reduced after 8 years.

Key words: nasal obstruction, rhinomanometry, nasal septum surgery, nasal airway resistance, age groups

INTRODUCTION

Most patients suffering from nasal stuffiness and with a high nasal airway resistance (NAR) after decongestion will undergo a form of surgical treatment. Common reasons for not to operate are either that patients are afraid of the operation, or that surgeons do not trust the rhinomanometric result.

It seems logical that nasal obstruction verified by a high NAR value after adequate decongestion of the nasal mucosa remains unchanged in the absence of any external intervention to the nose. However does the nose grow with age resulting in wider nasal cavities or does the nasal mucosa atrophy as part of the aging process? The nose changes as the body ages and Edelstein showed an increase in nasal airway resistance in people with no nasal complaints [(1)]. Another study showed that the nose becomes wider with age [(2)]. We found that in patients who underwent septal surgery the NAR value (before and after decongestion) of the whole nasal cavity as well as the preoperatively wider cavity, decreased significantly during 9 years of follow-up [(3)]. However, it is not known what happens to patients with nasal stuffiness left without operation. We decided to follow-up all non-operated patients who initially came to our department because of nasal stuffiness and who had a pathological high NAR after decongestion.

MATERIAL AND METHODS

Patients

Between 1995 and 1999 we found 59 patients that were not operated on, but had a pathological high NAR after decongestion on at least one side. All 59 patients were invited by letter for a follow-up investigation, and 49 persons (83 %) replied. Of the 49 persons three had moved, and two persons denied any nasal complaints and therefore declined another investigation. Thus, 44 non-operated patients, 14 women and 30 men, mean age 52 years (range 22-78) participated in the study. The initial reasons for not to operate on 27 patients that were recommended septoplasty were fear of surgery, and lack of time; 12 patients were primarily offered nasal steroids; 5 were recommended other treatments such as weight loss and snoring surgery (uvulopalatopharyngoplasty).

Rhinomanometry

All 44 patients underwent a second assessment on average 8 years (range 7-9 years) after their baseline investigation.

*Received for publication: February 9, 2008; accepted: July 6, 2008

A clinical ENT examination and a rhinomanometric measurement were performed in all patients. The patients also answered a standard rhinomanometric survey, in which 11 patients reported suffering from allergy at baseline.

We have described the rhinomanometric survey in details earlier, where reproducibility and validity issues are discussed [4,5]. Questions about nasal stuffiness were "do you suffer from nasal stuffiness" and "if so how often…". The degree of nasal stuffiness was also specified. The rhinomanometric measurement was done with the same device (Rhino Comp®, Sweden), using the same procedure, and by the same staff as for the baseline investigation. The measurement was done in a room with constant humidity. Calibration of the entire rhinomanometer system was done every morning. The pneumotachograph was checked by connecting a metal artificial nose, not sensitive to age variations, to the built-in calibration pump. Calibration was continued until measurements gave values determined by the manufacturer. The equipment was regularly tested by the medical technical department at Växjö Central Hospital.

The limits for normal and pathological NAR values after decongestion were the same. Active anterior rhinomanometry was performed with the nasal mucosa first undecongested. Thereafter the nasal cavity was decongested with two puffs of 0.1 % xylometazoline sprayed into each nasal cavity followed by two more puffs 7-8 minutes later. After a further 7-8 minutes a second rhinomanometry was performed [6]. The pressure-flow curves were evaluated in a polar coordinate system. Statistical evaluation was based on v_2 - a value calculated from points on the whole curve where it intersects a circle with a radius of 200 Pa on the abscissa and of 200 cm_3/sec on the ordinate. The relevant nasal airway resistance R_2 is tan v_2. Resistance at 150 Pa, R 150, can be calculated from R_2. NAR was presented in v_2 values as previously outlined by Broms et al. [7]. NAR can be given as a resistance R at 150 Pa or as v_2, according to the committee report on standardization of rhinomanometry [8], and the consensus report on acoustic rhinometry and rhinomanometry [9]. The v_2 varies between 0 and 90 degrees with the normal mean value for the decongested mucosa being 13.1 ± 6.8 degrees [6]. In our study we used limit values as described by Broms [10].

Statistics

The results were analysed using the SPSS software for Windows version 13. Logistic regression models and parametric and non-parametric statistical methods were applied. This study was conducted in accordance with the Declaration of Helsinki and since the patients were part of a clinical follow-up procedure an ethical review board application was not considered necessary.

RESULTS

Of the 44 patients who came back for a renewed investigation nasal stuffiness had disappeared in 2 patients (4%) and was reduced in 14 patients (32%). In 22 patients (50%), nasal stuffiness was unchanged, and for 6 patients (14%) it had increased. At follow-up we offered septum surgery to 13 patients, nasal steroids to 13 patients, and 18 patients were not offered any treatment.

The average nasal airway resistance (NAR) values after decongestion were improved for all 44 patients; both for the 16 patients with subjectively reduced nasal stuffiness and for the 28 which did not improve (Table 1). The reduction in NAR was greater for the narrower side in both groups.

In logistic regression analyses we merged "disappeared" and "reduced" subjective nasal stuffiness into a subjective improvement variable. The subjective improvement of nasal stuffiness

Table 1. Rhinomanometric results for 44 non-operated patients with nasal stuffiness at baseline; 16 improved and 28 not improved at 8-year (range 7-9) follow-up.

	NAR-values of 44 non-operated patients, subjectively improved from nasal stuffiness or not								
	Improved, n=16			**Not improved, n=28**			**All non-operated, n=44**		
	Baseline v_2 mean (SD) R_2 mean	Follow-up v_2 mean (SD) R_2 mean	Paired t-test, p-value	Baseline v_2 mean (SD) R_2 mean	Follow-up v_2 mean (SD) R_2 mean	Paired t-test, p-value	Baseline v_2 mean (SD) R_2 mean	Follow-up v_2 mean (SD) R_2 mean	Paired t-test, p-value
Wider side:									
Before decongestion	29 (17) 0.55	22 (15) 0.40	0.25	32 (21) 0.62	24 (20) 0.45	0.1	30 (19) 0,57	24 (18) 0.45	0.042
After decongestion	20 (9) 0.36	14 (6) 0,25	0.06	20 (10) 0.36	15 (8) 0.27	0.02	20 (10) 0.36	15 (8) 0.27	0.002
Narrower side:									
Before decongestion	59 (23) 1.66	47 (22) 1.07	0.12	61 (19) 1.80	56 (21) 1.48	0.4	60 (20) 1.73	53 (22) 1.32	0.09
After decongestion	52 (19) 1.28	37 (23) 0.75	0.001	45 (17) 0.36	30 (19) 0.58	0.002	48 (17) 1.11	33 (21) 0.65	<0.001

Table 2. Variables associated with improved subjective nasal stuffiness at 8 years (range 7-9) follow-up in 44 patients with baseline nasal stuffiness without surgery. Odds ratios with 95% confidence intervals. NAR-values after decongestion. * = $p<0.05$, ** = $p<0.01$.

Tested variables	Univariate analysis OR (95% CI)	Multiple regression model OR (95% CI)
Age (years)	1.1 (1.02 – 1.2)*	**1.1 (1.01 –1.14)***
Allergy prevalence	21 (2 – 196)**	**9.0 (1.5 – 52.5)***
Follow-up time (years)	0.4 (0.1 –1.5)	
Baseline NAR, narrower side (v_2)	1.03 (0.97 – 1.09)	
Follow-up NAR, narrower side (v_2)	1.02 (0.97 – 1.08)	
Baseline NAR, wider side (v_2)	1.06 (0.92 – 1.21)	
Follow-up NAR, wider side (v_2)	0.98 (0.85 – 1.14)	
Female gender	0.3 (0.03 – 2.8)	

at follow-up was thus made a dependant variable in multiple logistic regression models and was significantly associated with increasing age and prevalence of allergy (Table 2). Thus, with higher age the probability of belonging to the improved group increased. Also, having allergic problems at baseline was significantly and independently associated with being in the subjectively improved group at follow-up. No other variables correlated to improvement of subjective nasal stuffiness neither in univariate analysis nor in multiple logistic regression models (Table 2). We also tried regression models with other variables than seen in Table 2, i.e. types of treatment at baseline or at follow-up, but no significant correlations emerged.

DISCUSSION

This study shows the natural course of so-called organic stenosis of the nasal cavity. Organic nasal stenosis is defined as a condition with a pathological high NAR after decongestion. We found a significant reduction of NAR both for the narrower and for the wider side after decongestion at an 8-year (range 7-9) follow-up in a group of 44 non-operated patients with a pathological NAR at baseline. Since we used the same procedure for decongestion of the nasal mucosa both at baseline and at follow-up we assume that the reduction was real. We also found that subjective improvement of nasal stuffiness was significantly correlated with two factors, increased age and prevalence of allergy.

In 1988 we compared rhinomanometric values both 9 months and 9 years after septum surgery [3]. We found a significant reduction of NAR, but only for the preoperatively wider side and for the total nose. The reduction for the preoperatively narrower side was not significant. In a ten-year follow-up study after septum surgery by Bohlin and Dahlqvist a significant NAR reduction for the preoperatively narrower cavity from v_2 51 to 23 at three months, and to v_2 18 at 10 years postoperatively was seen [11]. However their patients were operated on while the patients in the present study were left without surgery, yet the NAR values of our patients were reduced significantly.

We can only speculate about why NAR decreased with increasing age in our study. Atrophy of the aging mucosa may eventually make it easier to decongest an aged mucosa, which then will have lower NAR values. Another explanation can be that the nasal bone grows, which would make the nasal cavity bigger with age. Damon found that both nasal length and breadth increased with age [2]. Edelstein showed that the nasolabial angle increased with age and the height/length ratio of the nose also correlated with age [1].

Bohlin and Dahlqvist found that 30% of patients experienced a diminished nasal stuffiness and for 9% nasal stuffiness disappeared 10 years after septum surgery [11]. These results resemble those of the present study where nasal stuffiness disappeared or was reduced for 36% of our patients left without surgery. In a previous follow-up study we found that 21% of 95 patients (mean age 40 years) suffering from nasal stuffiness with a normal NAR, and therefore not operated, had no stuffiness at all 5 years from baseline [12]. Wrobel et al. found a decreased nasal mucosal sensitivity in older subjects when testing the nasal mucosa to an air jet stimulus [13], and in another study intranasal trigeminal sensitivity assessed by stimulating the nasal mucosa was lower in older subjects [14]. Decreased nasal mucosal sensitivity could thus be another explanation to why nasal stuffiness disappears with age in many patients. When Edelstein [1] studied persons aged from 21 to 94 years without any nasal problems he found that nasal obstruction was not correlated with age. Yet, a significant positive correlation was found between age and increased nasal resistance before and after decongestion for both sides of the nose. Although these results contradict our findings, it has to be pointed out that all our patients had some sort of nasal pathology at baseline and were followed for many years. Edelstein, on the other hand, did a cross sectional study of persons at different ages with no nasal complaints. In another Finnish cross-sectional study of 332 dental patients aged 16 to 82 years no correlation between age and nasal airflow rate or nasal pressure was observed [15]. However, in a cross-sectional American study comparing 35 children, 57 teenagers and 105 adults, a clear age related reduction in nasal resistance was seen [16].

We do not know why NAR values decreased with age as seen both in our study of non-operated patients and in two studies after septoplasty [3,11], nor do we know why subjective nasal stuffiness seems to diminish with age. Yet, we suggest that the practical consequence should be to age adjust the limit values for normal and pathological NAR. In this study mean age at follow-up was 52 years and mean v_2 was 48 degrees at baseline and 33 degrees at follow-up for the narrower side of the nose.

This v_2 reduction is not insignificant in clinical practice. The NAR limit value in the present study is based on the study by Broms et al. [10] where mean age was 32 years. In our study of normal values [6] the mean age was 31 years and the mean NAR value was 14.0 ± 7.9 for the narrower cavity. In these studies a correlation was found between NAR of the decongested nose and body height, but no correlation between NAR and either body weight, BMI, or age [6,10]. In a German study of 54 volunteers, mean age 32 years, without nasal complaints no correlation was found between NAR and either age, sex, height or weight [17].

A practical consequence of our study, where nasal stuffiness disappeared or diminished in 36% of the patients, and average NAR values were reduced, is to recommend a wait and see policy, especially for elderly patients.

REFERENCES

1. Edelstein DR. Aging of the normal nose in adults. Laryngoscope. 1996; 106: 1-25.
2. Damon A. Aging and Human Development. 1972; 3: 169-173.
3. Jessen M, Ivarsson A, Malm L. Nasal airway resistance and symptoms after functional septoplasty: comparison of findings at 9 months and 9 years. Clin Otolaryngol Allied Sci. 1989; 14: 231-234.
4. Jessen M Janzon L Prevalence of non-allergic nasal complaints in an urban and a rural population in Sweden Allergy 1989: 44: 582-587.
5. Jessen M. Nasal Obstruction. Doctoral Thesis, University of Lund, Malmö General Hospital 1989.
6. Jessen M, Malm L. Use of pharmacologic decongestion in the generation of rhinomanometric norms for the nasal airway. Am J Otolaryngol. 1988; 9: 336-340.
7. Broms P, Jonson B, Lamm CJ. Rhinomanometry-a system for numerical description of the nasal airway resistance. Acta Otolaryngol. 1982; 94: 157-168.
8. Clement PAR. Committee report on standardization of rhinomanometry. Rhinology 1984; 22: 151-155.
9. Clement PAR, Gordis F. Consensus report on acoustic rhinometry and rhinomanometry Rhinology 2005; 43: 169-179.
10. Broms P. Rhinomanometry. III. Procedures and criteria for distinction between skeletal stenosis and mucosal swelling. Acta Otolaryngol. 1982; 94: 361-367.
11. Bohlin L, Dahlqvist Å. Nasal airway resistance and complications following functional septoplasty: A ten-year follow-op study. Rhinology 1994; 32: 195-197.
12. Jessen M, Malm L. Longterm follow-up of patients with nasal stuffiness and normal NAR Acta Otolaryngol. 1984; 214: 95-98.
13. Wrobel BB, Bien AG, Holbrook EH et al. Decreased nasal mucosal sensitivity in older subjects. Am J Rhinol. 2006; 20: 364-368.
14. Frasnelli J, Hummel T. Age-related decline of intranasal trigeminal sensitivity: is it a peripheral event? Brain Res. 2003; 987: 201-206.
15. Crouse U, Laine-Alava MT. Effects of age, body mass index, and gender on nasal airflow rate and pressures. Laryngoscope. 1999; 109: 1503-1508.
16. Vig PS, Zajac DJ. Age and gender effects on nasal respiratory function in normal subjects. Cleft Palate Craniofac J. 1993; 30: 279-284.
17. Gammert C, Hampl K, Herrmann P. [Normal values in rhinomanometry] HNO. 1988; 36: 399-405. German.

Dr Helle Thulesius
ENT-Department
Central Hospital
SE-35185 Växjö
Sweden

E-mail: helle.thulesius@ltkronoberg.se