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Nasal mucoliliary clearance in patients with septal deviation

Annelie Ginzel and Peter Illum, Aarhus, Denmark

SUMMARY

We studied nasal mucociliary clearance by means of the saccharin-sky-blue technique in patients with septal deformities of the nose before and after plastic operation. The results were compared with clearance measurements in healthy persons. Prior to operation nasal clearance was statistically significantly slower ($p < 0.05$) in the patient group, and mucociliostasis occurred in 21% of all measurements compared with only 3% in the group of healthy persons. 3 months after septoplasty nasal clearance was found normal in all but 3 persons who had an active nasal infection at the time of postoperative investigation. In our opinion the saccharin-sky-blue test serves as a valuable technique in the evaluation of nasal mucociliary function prior and subsequent to operation of patients with septal deformities of the nose.

A major defense mechanism of the human organism against airborne pollution and infection is a normally functioning mucociliary transport in the nose. Because of its contents of immunologically active substances the mucus impregnates the nasal cavity like a kind of antiseptic paint. The cilia function as a conveyor belt moving the mucuslayer in pharyngeal direction.

It is well-known that unilateral obstruction of the nose – as is for instance the case in patients with septal deviation of the nose – may give rise to mucosal changes in the contrary side of the nasal cavity, such as cilia exfoliation or squamous epithelial metaplasia (Hilding, 1932); these changes may be localized to larger parts of the mucosa or only quite small spots that have been termed "dead spots" by some authors (Proctor et al., 1973). These "dead spots" are presumeably caused by changes of the normally predominantly laminar type of airsteam through the nose into a more turbulent type of airstream.

Only few authors have reported on nasal mucociliary transport function in patients with septal deviation. Quinlan et al. (1969) found in 3 persons with marked septal deviation a normal mucociliary function in the unobstructed side of the nose and a heavily reduced transport rate in the obstructed side. Using a tracer technique these authors furthermore observed that radioactive-tagged particles were either carried round septal spines and crests, or that transport totally ceased near such obstructions. Using a similar technique Simon et al. (1977) observed that in 3 persons a tagged particle after application on the inferior turbinate stopped moving more posteriorly in the nasal cavity on a septal spine.

No study of nasal mucociliary function in a larger number of patients with septal deviation has been carried out. Likewise there has been no investigation on how nasal mucociliary transport function is affected by septoplasty.

MATERIAL AND METHOD

22 patients participated in our study, 20 men and 2 women, who were referred to our unit because of septal deviation and had a septoplasty carried out. The average age was 30 years (range 18 to 54 years). 5 patients had previously suffered from sinusitis. No patient did, however, show roentgenological signs of sinusitis on the day of admittance.

In order to measure nasal mucociliary function we employed the saccharin-sky-blue test (Andersen et al., 1974; Ginzel and Illum, in press). This method consists in measuring nasal mucociliary clearance, which is defined as the time lag between application of a small dyed saccharin particle on the inferior turbinate, approximately 1 cm behind its anterior edge, and the patient's sensation of a sweet taste.

We tried to obtain two measurements in each side of the nose on the day before operation. It was necessary, however, that no taste sensation was left, when the next test was to be carried out, and therefore could four measurements not be accomplished in some patients. The results of measurements in the patient group were compared with measurements of nasal saccharin clearance in a group of 60 healthy persons (Ginzel and Illum, in press).

3 months after operation the patients were called in for a follow-up examination. On that occasion nasal clearance was measured on the side of the nose that had preoperatively shown the poorest mucociliary function.

RESULTS

Before operation (Figure 1)

In 22 patients a total of 73 tests were carried out and compared with 120 tests in 60 healthy persons. Nasal clearance above 30 minutes was regarded as mucociliostasis; this was found in 21% of measurements in the patient group compared to 3% in the control group. These differences are statistically highly significant. The intraindividual variation of 2 clearance measurements in one person in the same side of the nose turned out to be 1.8 times bigger in the patient group than in the control group ($p < 0.05$). In 2 patients the test could not be carried out in the obstructed side of the nose, because an anterior septal luxation made it impossible to applicate the dyed particle without touching the septal mucosa, which resulted in immediate sneezing and marked secretion.

After operation

14 of the 22 patients came for a follow-up examination 3 months subsequent to

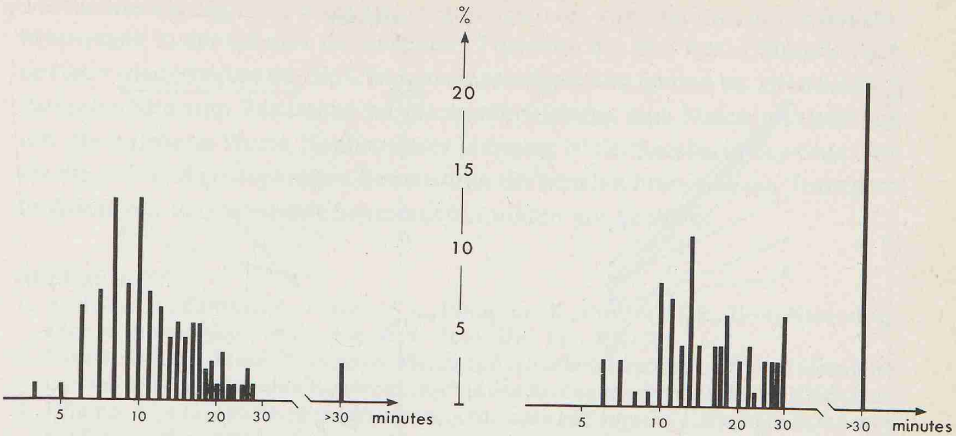

Figure 1. Nasal mucociliary clearance: saccharin-sky-blue test

a. 120 measurements in 60 healthy persons (2 tests pr. person)

b. 73 measurements in 22 patients with septal deviation of the nose (3 to 4 tests pr. person)

operation and had nasal clearance measured in the side of the nose with the poorest preoperative mucociliary transport. Pre- and postoperative results of clearance measurements are shown in Figure 2.

In 11 of the 14 patients clearance values were within normal range (Figure 2a), including one patient with unchanged mucociliary transport rate, who postoperatively had a small septal perforation (Figure 2a, dotted line).

In 3 of the 14 patients nasal mucociliary function had not improved postoperatively (Figure 2b); 2 of these had a cold on the day of follow-up examination and showed mucociliostasis; the third patient continued complaining of frequent attacks of sinusitis and had recently had treatment for this.

DISCUSSION

In our study we have demonstrated that patients with septal deviation of the nose have a much poorer nasal mucociliary transport function than healthy persons, and in 21% of all preoperative measurements there was mucociliostasis. Attempts at comparing preoperative measurements in each side of the nose separately proved no difference between the most obstructed and the least obstructed side. This was not to be expected either, as it is well-known that a severe luxation of the anterior edge of the septum, for instance, may give rise to rather pronounced nasal stenosis, while the ciliated columnar epithelium at the same time becomes highly differentiated, resulting in fast mucociliary transport. Our material does not permit a comparison between preoperative measurement results on the one hand and the nature and localization of the pathological changes on the other hand.

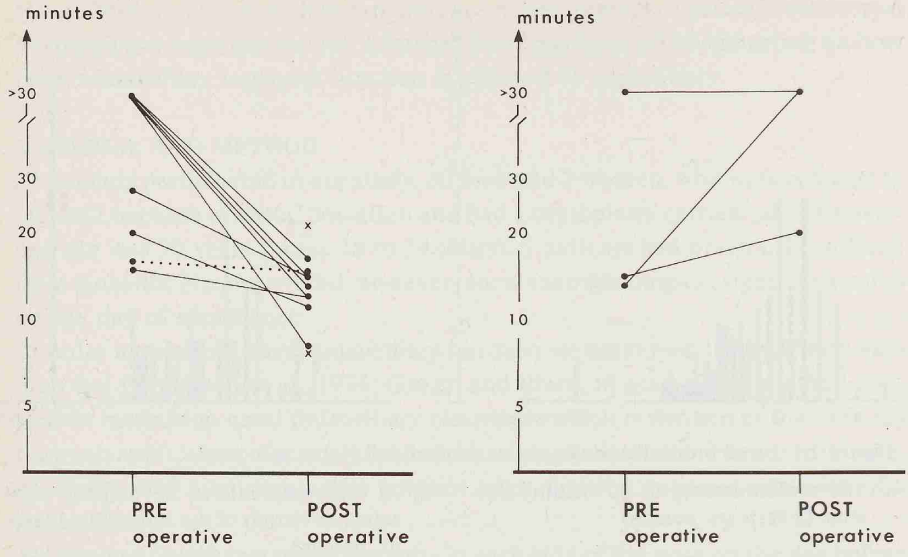

Figure 2. Nasal mucociliary clearance in 14 patients before and after septoplasty.

a. 8 patients with improved postoperative clearance
2 patients without preoperative test ("x")
1 patients with postoperative septal perforation (.. .. ..)

b. 3 patients with active nasal infection at the time of postoperative follow-up examination – no improvement of nasal clearance.

Postoperative measurements of nasal clearance have shown a marked fall in all patients with an uncomplicated course and a successful outcome of septoplasty. At the time of postoperative control 2 patients had mucociliostasis, and 1 patient had a slower nasal clearance post- than preoperatively. These 3 patients had an active nasal infection which can affect mucociliary transport as much as 6 weeks (Ginzel and Illum, in press; Sakakura et al., 1973).

Thus, our study has shown that nasal mucociliary transport returns to normal after sufficient removal of anatomical obstacles such as spines and crests and reestablishment of normal air pasage. The saccharin-sky-blue test is easy to administer and causes minimal discomfort for the patient. It presents a suitable method in evaluation patients prior and subsequent to septoplasty.

ZUSAMMENFASSUNG

Wir untersuchten die nasale mucociliare Transportfunktion mittels des Saccharin-sky-blue-Tests an Patienten mit Nasenseptumdeviation vor und nach Operation. Die Messergebnisse verglichen wir mit Messungen der nasalen mucociliaren Clearance an gesunden Personen. In der Patientengruppe waren die Werte für die nasale Clearance präoperativ statistisch signifikant langsamer ($p < 0{,}05$), und

Mucociliostase lag in 21% der Messergebnisse vor, während dies nur in 3% aller Messungen in der Gruppe der gesunden Personen der Fall war. 3 Monate postoperativ wiederholten wir die Clearancemessungen und fanden bei allen ausser 3 Patienten, die zum Zeitpunkt der Nachuntersuchung eine Naseninfektion hatten, normalisierte Werte. Nach unserer Meinung ist der Saccharin-sky-blue-Test für die prä- und postoperative Beurteilung der nasalen mucociliaren Transportfunktion von Patienten mit Septumdeformitäten gut geeignet.

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Annelie Ginzel and Peter Illum
Department of Otorhinolaryngology
Aarhus University
Kommunehospitalet
DK-8000-Aarhus, Denmark