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Motor activity of the nasal mucosa ciliary apparatus (MACA) before and after septoplasty

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Abstract: Therefore, surgical correction of the nasal septum is one of the most common operations in otorhinolaryngology. At the same time, the literature does not sufficiently cover data on the motor activity of the ciliary apparatus in patients who underwent surgery for curvature of the nasal septum.
Keywords: CBF- ciliary beating frequency, MACA- motor activity ciliary apparatus, PNS- paranasal sinuses NS- nasal septum UP- upper part LP- lower part, DNS- Deviation of nasal septum, NSDZ- nasal septum deepening zone, IC- inferior conchae.

Introduction

Deformities of the nasal septum are among the most common diseases of the ENT organs. Prolonged violation of nasal breathing leads to the development of various forms of chronic rhinitis, olfactory disorder, and inflammation of the paranasal sinuses (PNS), pharynx, larynx, headache, middle ear diseases. Therefore, surgical correction of the nasal septum is one of the most common operations in otorhinolaryngology. At the same time, the literature does not sufficiently cover data on the motor activity of the ciliary apparatus in patients who underwent surgery for curvature of the nasal septum.

The purpose of the study

To study the motor activity of the nasal cavity ciliary apparatus in patients with nasal septum deformities both before and after septoplasty**.**

Materials and methods

The clinical analysis was based on 20 healthy adult volunteers and 110 patients with nasal septum deformity.

Distribution of patients with nasal septum deformity by age and gender

	Age groups				
	Up to 20 years old	21-30 years old	31-40 years old	41-50 years old	Total:
Men	14	29	22	6	71
Women	8	16	13	2	39
Total:	22	45	35	8	110
%	20	40,9	31,8	7,3	100

The diagnosis was made on the basis of complaints of difficulty in nasal breathing and a rhinoscopic picture, which made it possible to identify various types of deformities of the nasal septum in patients.

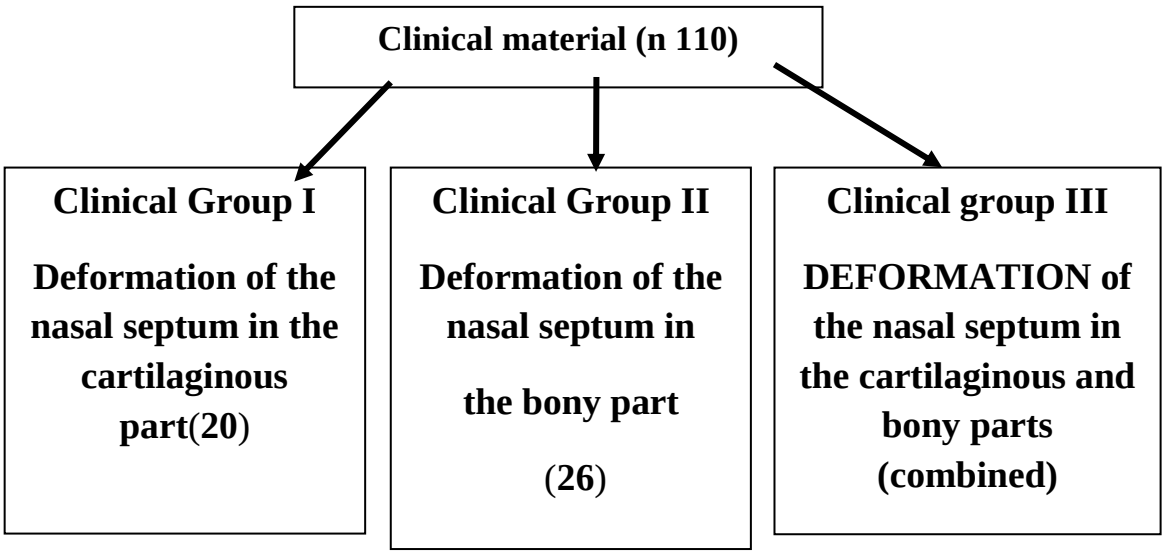

Fig.1. Scheme of distribution of patients with nasal septum deformity into clinical groups.

To study the data of the nasal mucosa, a diagnostic complex and a computer program were used, which were developed at the Department of Otorhinolaryngology of the Yaroslavl State Medical Academy and at the Department of Dynamics of Electronic Systems of the Yaroslavl State University in 2005 (V.S.Kozlov et al., 2005). The diagnostic complex includes a LOMO Mikmed-2 light microscope (Russia) with magnification up to 900x, an Endocam-600K video camera (Azimut NPC, Russia), a Raster RT851 video capture board and a personal computer.

The methodology of the MACA study was carried out according to the method of A.I. Kramny. In the nasal cavity, with the help of a special spoon with a length of 17 cm and a diameter of the working surface of 2 mm, scraping was performed from the mucous membrane. The taken material was placed on a slide with a recess in the center with a depth of 1.7 mm in a Ringer-Locke solution, covered with a cover glass and placed under the microscope lens. 8-9 sections with functioning cilia were archived in computer memory, after which the cilia of the epithelium were virtually marked with markers in each video frame, the frequency of their movements was calculated using the program, and then the average value of the ciliary beating frequency (CBF) in Hz was automatically determined.

To determine the MACA index in patients with both nasal septum deformity and after septoplasty, scrapings were taken from the mucous membrane of five anatomical zones of the nasal cavity:

1. The zone of the upper part of the cartilaginous part of the nasal septum, retreating 1.5-2 cm from the entrance to the nose.
2. The zone of the lower part of the cartilaginous part of the nasal septum, retreating 1.5-2 cm from the entrance to the nose.
3. The zone of deformation of the nasal septum.

4. The zone of "deepening" of the nasal septum on the side opposite to the deformation.
5. The zone of the lower nasal concha, retreating 1 cm from its anterior end.

The data obtained during the study were compared with the MACA corresponding to the norm. To do this, scrapings were taken from the nasal mucosa of healthy volunteers in five zones:

1. The zone of the upper part of the cartilaginous part of the nasal septum, retreating 1.5-2 cm from the entrance to the nose.
2. 2. The zone of the lower part of the cartilaginous part of the nasal septum, retreating 1.5-2 cm from the entrance to the nose.
3. The zone of the middle part of the nasal septum.
4. The zone of the bone part of the nasal septum.
5. The zone of the lower nasal concha, retreating 1 cm from the front end of the concha.

Results.

All patients with nasal septum deformity underwent standard septoplasty according to the M.Cottle technique (M.Cottle et al., 1958) and bilateral submucosal vasotomy of the lower nasal concha.

In the postoperative period, the patients were monitored for 3 months. The entire period of patient observation consisted of four visits:

* Visit T0 - before the operation;
* T1 visit - 2 weeks after surgery (early postoperative period);
* Visit T2 - 1 month after surgery (late postoperative period);
* T3 visit - 3 months after surgery (period of dynamic observation).

It was noted that in the zone of deformation of the nasal septum, the CBF was the smallest. In clinical group I, this indicator did not exceed 2.95 ± 0.37 Hz, in group II – 2.38 ± 0.68 Hz, in group III - 2.84 ± 0.46 Hz. The differences between the groups are not significant ($p>0.05$). However, compared with CBF in other studied areas of the nasal cavity, the differences were statistically significant ($p<0.05$). Moreover, the CBF in the other four zones significantly exceeded the MACA index in the deformation zone. In addition, some patterns have been identified in these zones. Thus, a comparative analysis of the values of CBF in the cartilaginous part of the nasal septum (upper and lower divisions) and in the area of the lower nasal concha showed no significant differences between the zones in each of the clinical groups ($p>0.05$). There were no differences between the groups in the MACA index in the area of the upper nasal septum and on the lower nasal concha ($p>0.05$).

CBF of the mucous membrane in different anatomical zones of the nasal cavity is normal and with deformities of the nasal septum (visit T0)

Category of examined persons	CBF (Hz)				
	Cartilaginous part of NS		Zone of DNS	NSDZ	IC
	UP	LP			
Group I Deformation	4,38±0,29*	3,58±0,38*	2,95±0,3*	4,99±0,35	5,12±0,59

of the nasal septum in the cartilaginous part					
Group II Deformation of the nasal septum in the bony part	4,68±0,35*	4,82±0,39*	2,38±0,68*	4,85±0,42	4,20±0,85
Group III Combined deformation of the nasal septum	4,14±0,32*	3,10±0,32*	2,84±0,46*	4,08±0,38	4,05±0,86
Norm	Cartilaginous part of NS			Bony part of NS	IC
	UP	IP	MP		
	9,44±1,79	8,45±1,84	8,56±1,73	9,14±2,29	5,71±0,89

* NP - nasal septum, UP - upper part, LP - lower part, MP - middle part, INC - lower nasal conch, DNS - deformation of the nasal septum, NSDZ - zone of "deepening".

• * $p<0.05$ - differences in indicators are statistically significant compared to the age norm.

In the zone of the lower nasal septum, the highest value of CBF was detected in clinical group II (4.82± 0.39 Hz), and in the zone of the nasal septum on the side opposite to the deformation, in clinical group III, the lowest value of CBF (4.08± 0.38 Hz) ($p<0.05$) was recorded.

In comparison with the normal indicators of MACA in all patients, regardless of the type of deformation of the nasal septum, there was a significant and significant decrease in CBR in the studied areas of the nasal septum ($p<0.05$). And only on the lower nasal conch, the CBF did not differ from the age norm ($p>0.05$). Further, the results of scraping from each zone will be considered separately.

The zone of the upper cartilaginous part of the nasal septum.

2 weeks after septoplasty (visit T1), no epithelial cells with functioning cilia of the ciliated epithelium could be detected in all patients of clinical group II in the preparations taken from this zone. Therefore, the MACA indicator was estimated as equal to zero. In clinical groups I and III, the CBF in this zone was quite low and did not even reach 1 Hz: in group I, the MACA index was 0.32 ± 0.23 Hz, in group III – 0.29 ± 0.16 Hz.

1 month after the operation, there was a significant dynamics of MACA, but the CBF was significantly lower than before the operation. 3 months after the operation (visit T2), a significant increase in CBF was observed in all clinical groups compared to visit T1. However, in none of the patients did the CBR reach values corresponding to the age norm.

The zone of the lower cartilaginous part of the nasal septum.

During the T1 visit, the absence of cells with functioning epithelial cilia in this zone was found in all patients of clinical group I. In clinical groups II and III, the CBF was low, 0.18±0.10 Hz and 0.52±0.27 Hz. During the T2 visit, there was a slight increase in CBF, in group I - up to 2.27 ± 0.32 Hz, in group II - up to 3.13± 0.69 Hz, in group III - up to 2.81± 0.34 Hz. As in the previous description, in none of the studied groups did the value of the MACA indicator reach the age norm.

The zone of nasal septum deformation.

During the T1 visit, in all clinical groups, the MACA index was equal to 0. During the T2 visit, although the appearance of cells with functioning cilia in the preparations was recorded, the CBF was low: in group I – 1.68 ± 0.40 Hz, in group II - 1.40± 0.35 Hz, in group III – 1.32± 0.28 Hz. During the T3 visit, the CBF was restored to the original values obtained before the operation. In none of the cases did we get the values of the CBF corresponding to the age norm.

The area of the nasal septum on the opposite side to the deformation.

In this zone, during the T1 visit, the lowest CBF was in patients of clinical group I – 0.32 ± 0.23 Hz. In clinical group II, the MACA index was 1.09 ± 0.48 Hz, in clinical group III – 1.04 ± 0.46 Hz. During the T2 visit in clinical group I, the CBF increased to 3.08 ±0.65 Hz, in group II – 3.40± 0.71 Hz. In group III, the CBF increased to the initial values and amounted to 3.48 ± 0.48 Hz. By the time of the T3 visit, there was an even greater increase in the values of the CBF, but the MACA indicator was also below the age norm.

The zone of the lower nasal concha.

As in the previous zones, the CBF on the lower nasal concha during the T1 visit was quite low: in patients of clinical group I - 0.24 ± 0.17 Hz, clinical group II - 0.20± 0.12 Hz, clinical group III - 0.35± 0.18 Hz (differences between groups are unreliable, $p > 0.05$). During the T2 visit, the greatest increase in CBF values was observed in clinical group I (3.08±0.65 Hz) and in clinical group III - 3.34±0.48 Hz. By the T3 visit, the values of the MACA index in all groups were equal to each other, but were significantly lower than the initial values and the age norm.

Conclusions.

Thus, in no case during 3 months after the operation, we did not observe the restoration of the CBF of the epithelium of the mucous membrane to normal values.