

## LONG-TERM RESULTS OF PARTIAL NASAL RECONSTRUCTIONS WITH INDIAN FLAP

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**The aim of the study** was clinical evaluation of the results following reconstruction with the Indian flap in patients with partial nasal defects, and estimation of their postoperative life quality in functional and aesthetic aspects.

**Material and methods.** We analyzed results in 38 patients who underwent reconstructions with the Indian flap in the Department of Plastic, Reconstructive and Aesthetic Surgery between years 2000-2013. The patients were followed-up for at least 2 years. We estimated their life quality in aesthetic and functional aspects after surgery.

**Results.** Observed complications of nasal reconstruction were alar asymmetry in 6 patients (15.8%), nasal obstruction in 6 persons (15.8%), wide postoperative scar in 4 (10.5%), and non-aesthetic appearance of the donor site in two cases (5.3%). Estimation of life quality post surgery in the examined group of patients revealed significant postoperative improvement in both functional and aesthetic aspects.

**Conclusions.** 1. Reconstructions of nasal defects with the Indian flap resulted in satisfactory long-term postoperative results, which confirms the efficiency of the applied technique. 2. Reconstructive surgery with Indian flap of individuals with partial nasal defects contributed to significant postoperative improvement in both functional and aesthetic aspects and their life quality.

**Key words:** nasal defects reconstructions, life quality

Reconstructions situated in the middle of the face are always challenging, with regard to their functional and aesthetic outcome, for plastic surgeons. Deformities of this localization are usually a consequence of trauma, cancer, inflammatory or systemic diseases, sometimes cocaine abuse, and extremely rarely, congenital malformations (1-6). The forehead flap as the best method for repair of extensive nasal defects after amputation was practiced in India, and mentioned in *Susruta Samhida* around 600 B.C. The technique was probably carried by Buddhist missionaries to Greece, where it was used by Celsus. A report about the Mughal Empire (second half of the 17<sup>th</sup> century) provided the description of the forehead rhinoplasty, but detailed information was given in the *Gentleman's Magazine* in 1794, and

than published by Carpie in 1816. The classic midline forehead flap, known as the Indian flap, was situated along vertical axis from the glabella to the hair-line, and was raised on both supratrochlear vessels (7). Flap's base for mobilization was modified later by various techniques (Lisfranc, Labat, Diffenbach), and the shape of the paddle varied from trapezoidal to "gullwing" (Gillies, Millard) (8). Flap's elevation changes from the subcutaneous layer peripherally to the subgaleal and subperiosteal layers closer to the pedicle area. Elongation can be reached by flap's curving along the hair-line, and by pedicle back-cutting in the glabella area. Based on a single supratrochlear vessel, paramedian oblique flap has the curve situated towards the defect side (9). Usually, forehead flaps are transferred in two stages,

but if needed additional procedures are performed (1, 10). In elderly patients, children, and any patient in whom the external pedicle or (multi) two-stage procedure is problematic it can be accomplished in a single stage (11). These operations should be planned according to individual indications, optimizing patients' safety, as surgical complication rates in these groups can be high (12).

Aim of the study was clinical evaluation of the results following reconstructions with the Indian flap in patients with partial nasal defects, and estimation of their postoperative life quality in functional and aesthetic aspects.

## MATERIAL AND METHODS

We analyzed 38 patients (14 – females, 24 – males), between 40- 86 years, with the mean age of 61.5 years, who underwent partial nasal reconstructions with forehead flap at the Department of Plastic, Reconstructive and Aesthetic Surgery between 2000 – 2013. Preoperative data included etiology and localization of the nasal lesion, demographic details: age, sex, presence of comorbidities (diabetes mellitus, lipid disorders, cardiovascular diseases), as well as nicotine use, drugs, past surgical procedures and average time of hospital stay (tab. 1, 2). Operation consisting of two parts was performed in 34 cases. The first part in-

Table 1. Etiology and localization of nasal defects in the examined patients

Localization of the lesion	Posttraumatic		After tumor resection				After lupus resection	
	M	F	BCC resection		SCC resection		M	F
			M	F	M	F		
Ala	2		4	2				
Sidewall			2	2				
Ala, sidewall							4	
Ala, tip			2					
Sidewall, tip			2					
Dorsum	2							
Sidewall, dorsum			2	2				
Tip	2							
Torsum, tip	2					2		
Ala, sidewall dorsum, tip						2		
Ala, dorsum								2
Whole nose							2	
Total	8		12	6	4	6		2

Table 2. Demographic data of the examined group of patients

Patients	M (24)	F (14)	Total (38)
Mean age (years)	58,4	66,7	61,5
Past and current diseases			
cardiovascular disease	6	4	10
diabetes 2 type	2	2	4
lipid metabolism disorders	2	2	4
habits – nicotine use	10	6	16
Other operations	2		2
Average time of hospital stay (days)			
Two stage reconstruction			
1 stage (12), 2 stage (4)	19	13	32
with chondrocutaneous composite graft (2)			
1 stage (13), 2 stage (3)	2		2
Three stage reconstruction with chondrocutaneous composite graft			
1 stage (3), 2 stage (13), 3 stage (7)	2		2
Delayed procedure (1)			
1 stage (15), 2 stage (9), 3 stage (8)	1	1	2

cluded reconstruction of the nasal defect with forehead flap raised on supratrochlear vessels contralateral to the defect, the second – pedicle resection and repair of the defect. Defects of four patients required a chondrocutaneous composite graft (from the tragus and concha). Delayed procedure was used in two patients with cardiovascular disease, smoking, at risk of flap loss. Primary donor site closure was done in 24 patients, whereas closure with skin graft in 14 cases. All patients were followed up in the Out Patient Clinic after one month, then after 3 and 6 months, and once a year in consecutive years (fig. 1 A, B, C, 2 A, B, C). We analyzed the results – early and long-term following nasal reconstruction. We compared the patients' quality of life evaluated pre- and post-operatively on the basis of personal questionnaire (scale of satisfaction) adopted at our Department, which focused primarily on functional (breathing), and aesthetic (appearance) status. Postoperative aesthetic and functional results were subjectively graded by a plastic surgeon and otolaryngologist on the basis of physical examination (scale of satisfaction). Having collected data from questionnaires, we performed statistical analysis to determine whether nasal reconstructive surgery has a significant impact on the aesthetic and functional aspect. To this end, we used Wilcoxon signed-rank test to assess patients' perception of the aesthetical and functional aspect before and after surgery. Statistical analysis was performed using IBM SPSS Statistics for Windows, Version 20.0 (IBM Corp. Armonk, NY).

Considering the possibility of mechanical trauma of nasal airways and cancer cells spread during these examinations, we postponed the preoperative estimation of functional patency of the nasal airways. In certain individuals, when postoperative airflow passage was not stable (nasal obstruction was observed), acoustic rhinometry and rhynomanometry were performed as complementary methods (twice). Acoustic rhinometry was performed using acoustic device GM A1 and rhynomanometry was carried out using rhynomanometr COMBI 4000 M. Airflow was measured at the pressure of 150 mPa, using the Bromm's method, in the ring of 200 mPa diameter. The results were registered at inspiration and expiration, separately for the left and right side of the nose. The results of acoustic rhinometry and rhynomanometry were compared with reference norms.



Fig. 1. Patient with tumor localized on the right ala, sidewall and tip, at the age of 68 years  
A – before surgery, B – one week after reconstruction with forehead flap, primary closure of donor side, C – six months after reconstruction with forehead flap

In clinical examination we used the scale of nasal patency abnormalities:

- 0-30% – no abnormality,
- 30% $\geq$ 50% – minimal nasal patency decrease, no clinical significance,
- 50% $\geq$ 70% – nasal patency decrease with clinical significance,
- 70% $\geq$ 90% – significant nasal patency decrease,

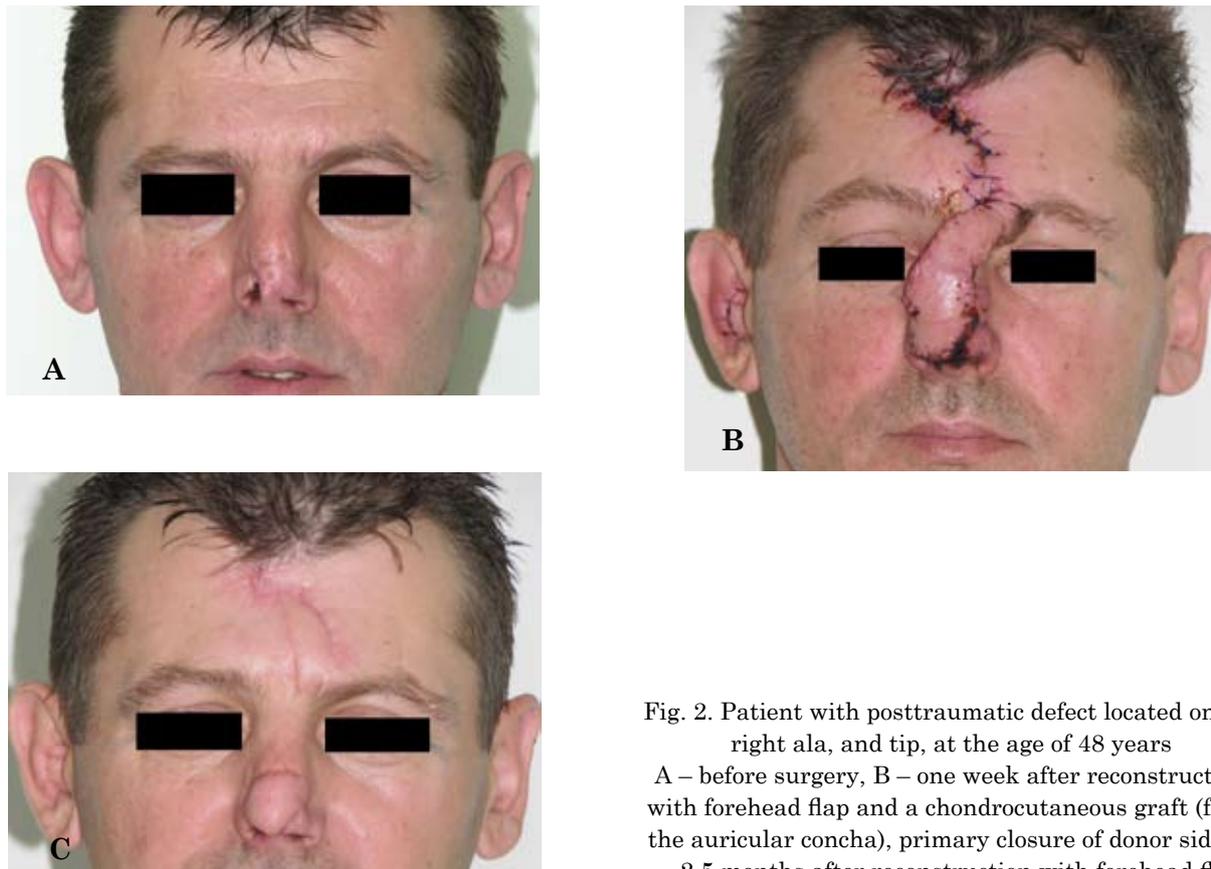


Fig. 2. Patient with posttraumatic defect located on the right ala, and tip, at the age of 48 years  
 A – before surgery, B – one week after reconstruction with forehead flap and a chondrocutaneous graft (from the auricular concha), primary closure of donor side, C – 2.5 months after reconstruction with forehead flap

90%≥100% – nasal obstruction;

Evaluation of nasal patency was done basing on readings from a graph illustrating the results of acoustic rhynometry and rhinomanometry.

RESULTS

Postoperative outcomes in the examined patients have been shown in tab. 3. Alar asym-

metry was revised twice surgically in a single case, for the remaining five persons the defect was insignificant and they did not want to undergo additional corrections. Appearance of the donor site in all individuals except two was satisfactory (linear, superficial, minor scar, even in color). Appearance-related concerns were the most important and stressful complaints in the opinion of 30 patients before

Table 3. Results of nasal reconstruction with forehead flap

Postoperative results and complications of nasal reconstruction	M	F	Total
Hematoma, bleeding	0	0	0
Abnormal wound healing	0	0	0
Infection	0	0	0
Flap necrosis	0	0	0
Life-threatening complications	0	0	0
Appearance of postoperative scars			
– linear	20	14	34
– wide	4	0	4
AAlar asymmetry	3	3	6
Displacement of medial eyebrow hair	0	0	0
Non-aesthetic appearance of the donor site (wide scar, color patch)	2	0	2
Nasal obstruction	4	2	6
Additional surgical revisions	1	0	1

nasal reconstruction. The evaluation of patients' overall satisfaction in two aspects (aesthetic, functional) has been shown in tab. 4, whereas postoperative estimation by otolaryngologist and plastic surgeon in tab. 5, 6. Postoperative estimation was based on adopted standards (tab. 7). Results of acoustic rhinometry, and rhynomanometry in comparison with reference norms in four patients revealed unilateral nasal patency decrease with clinical significance (close to the nasal valve), in two cases nasal patency was bilaterally significantly restricted.

Taking into consideration the patients' evaluation of aesthetic aspect, we observed that they find the outcome of surgery satisfying (mean score before surgery:  $1.89 \pm 0.73$  vs mean score after surgery:  $4.32 \pm 0.47$ ;  $p < 0.0001$ ). As for an assessment of functional aspect, patients' perception did not change significantly after surgery (mean score before surgery:  $4.05 \pm 0.77$  vs mean score after surgery:  $3.92 \pm 1.1$ ; ( $p = 0.53$ ). Therefore, performed reconstructive surgeries yielded deeply satisfying aesthetic results for both male and female patients.

## DISCUSSION

Nasal reconstruction with the use of forehead flap represents one of the best methods for repair of extensive nasal defects, allowing for near-normal functional and aesthetic postoperative results. However, the success of repair depends on local conditions such as etiology, location, depth of the lesion, and clinical status of the patient (5). As the number of elderly persons diagnosed with skin cancer increases, the ratio of complications after nasal reconstructions connected with multimorbidity specific for advanced age is high (13). In our study group systemic diseases were present in 47.4% of cases. On average, our patients underwent surgery in the 6/7<sup>th</sup> decade of life. The majority of nasal lesions resulted from removal of extensive skin cancers, located mainly on the ala, or sidewall and diagnosed as basal cell carcinoma (47.4%) or squamous cell carcinoma (26.3%). These observations correspond with the data of other authors (3, 14).

Currently, nasal reconstruction with the forehead flap can be performed as an isolated

Table 4. Evaluation of patient's overall satisfaction in functional and aesthetic aspects

Estimation of functional and aesthetic status in patient's opinion (scale of satisfaction)	Number of patients before nasal reconstruction		Number of patients after nasal reconstruction	
	M	F	M	F
General estimation of aesthetic status – $p < 0.0001$				
Completely satisfied			8	4
Satisfied			16	10
Moderately satisfied	8			
Slightly satisfied	10	8		
Not satisfied	6	6		
General estimation of functional status – $p = 0.53$				
Completely satisfied	6	4	6	4
Satisfied	14	8	14	8
Moderately satisfied	2*	2*		
Slightly satisfied	2*		2*	2*
Not satisfied			2*	

\* patients with postoperatively noted nasal obstruction

Table 5. Postoperative evaluation by otolaryngologist

Postoperative estimation of functional status (nasal patency) in otolaryngologist's opinion (scale of satisfaction)	Number of patients	
	M	F
Completely satisfied	20	12
Satisfied		
Moderately satisfied	2*	2*
Slightly satisfied	2*	
Not satisfied		

\* Patients with postoperatively confirmed nasal obstruction

Table 6. Postoperative evaluation by plastic surgeon

Postoperative estimation of aesthetic status in plastic surgeon’s opinion (scale of satisfaction)	Number of patients	
	M	F
Completely satisfied	10	6
Satisfied	9	5
Moderately satisfied	3*	3*
Slightly satisfied	2 $\alpha$	
Not satisfied		

Patients with postoperatively confirmed: \* nasal asymmetry,  $\alpha$  non-aesthetic appearance of the donor site

Table 7. Postoperative satisfaction survey by plastic surgeon, and otolaryngologist

Degree of satisfaction	Estimation standards
<b>Aesthetic status</b>	
Completely satisfied	Real contour of the reconstructed subunit
Satisfied	Almost real contour of the reconstructed subunit
Moderately satisfied	Imperfections are apparent
Slightly satisfied	Unreal contour
Not satisfied	Additional surgical revision is needed, unreal contour
<b>Functional status</b>	
Completely satisfied	complete ventilation, no abnormality
Very satisfied	minimal nasal patency decrease, no clinical significance
Moderately satisfied	nasal patency decrease with clinical significance
Slightly satisfied	significant nasal patency decrease
Not satisfied	nasal obstruction

procedure (84.2% from our study) or as a part of complex treatment. The former sometimes requires supplementary stages (techniques), such as expander use or cartilage graft (4 cases in our group), other flaps (septal pivot or galea) and/or subunit plasty. Although multi-stage reconstructions allow for restoration of nasal defects with satisfactory aesthetic and functional outcomes, but are related to longer treatment and increased complications risk, which limits the number of eligible individuals. Taking into consideration longer treatment and increased complications risk related to multistage reconstructions, satisfactory aesthetic and functional outcomes can be obtain in selected eligible individuals (young) with nasal defects (1, 15 – 19). In cases with systemic diseases, and/or concerns of flap loss, delayed procedure may improve the flap’s

survival (20). This approach was used in two cases from our group.

Reconstruction of full-thickness defects of the nose requiring lining, support and cover can result in postoperative imperfection of the shape and nasal congestion. Currently, there are few literature reports on such defects with the use of microvascular free tissue transfer (composite radial forearm flap, sometimes with costal cartilage) or prefabricated scalping forehead flap with iliac bone graft, concerning acceptable functional and aesthetic postoperative results (21, 22, 23). In these techniques of facial contour reconstruction large volumes of reliable tissue are available, however operative time and hospital stay are longer, as well as donor site scarring and morbidity.

We state that individual therapy should include precise planning (lesion’s characteristic features, the patient’s age, systemic diseases, smoking), it should be radical, but not burdensome for the patient (small number of donor sites, procedures and hospital stays) to decrease the risk of surgical complications. Thus, most lesions in patients from our study were qualified for reconstruction with the isolated forehead flap. We did not observe any abnormal wound healing, bleeding, flap loss or life threatening complications, although the ratio of diabetes (10.5%), cardiovascular diseases (26.3%) and smoking (42.1%) were relatively high in our senile patients. In some reports diabetes, increased age or vascular diseases were not significantly associated with higher rates of complications, but tobacco use was a major risk factor of flap necrosis (12, 24).

The most problematic aspect before surgery for 79% of our patients was the aesthetic outcome, especially appearance-related concerns. Before surgery, the majority (79%) was slightly satisfied or not at all satisfied with personal looks. Whereas, postoperatively all pa-

tients declared aesthetic improvement, and only one patient decided on alar asymmetry revision. Negative patient's, as well as otolaryngologist's, opinion of the functional status resulted from nasal obstruction. In the remaining cases the opinion was positive if the air flow was stable. Postoperative results are reflected in plastic surgeon estimation – moderate or slight satisfaction if alar asymmetry was present, or non-aesthetic appearance of the donor site was observed. Whereas, we have been satisfied with the results in the remaining cases.

Our observations referring to the distinct improvement of patient's quality of life in aesthetic and functional statuses after nasal re-

constructions with the use of the forehead flap correspond with apperceptions presented by other authors (1, 16, 25).

## CONCLUSIONS

1. Reconstructions of nasal defects with the Indian flap resulted in satisfactory long-term postoperative results, which confirms the efficiency of the applied technique.
2. Reconstructive surgery with Indian flap of individuals with partial nasal defects contributed to significant postoperative improvement in both functional and aesthetic aspects and their life quality.

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