Paramedian Forehead Flap in Large Nasal Skin Defects: Twenty-years' Experience

Original Investigation

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Abstract

Objective: Skin cancers occur most commonly in the head and neck region where the nose is the most commonly affected unit. The nose is the part of the face that is most exposed to trauma, sunlight, and other environmental factors. From the aesthetic and functional point of view, reconstruction of the defects occurring after skin cancer removal creates a great challenge for the surgeon. In this retrospective study, we present the success rates achieved in the past 20 years with paramedian forehead flaps used for repairing large defects of the nose.

Methods: The study included 62 patients who underwent paramedian forehead flap due to nasal skin tumor [basal cell carcinoma (BCC) and squamous cell carcinoma (SCC)] in Ege University Faculty of Medicine Otolaryngology Department between 2000 and 2020. Data on follow-up time, patients' age and gender, defect sizes, and tumor types were obtained retrospectively from patient files, histopathologic examination results and patient photographs. Additional diseases such as diabetes, hypertension, and coronary artery disease that could affect flap success, were noted.

Results: Out of 62 patients 29 (46.8%) were female and 33 (53.2%) were male. Their mean age was 61.4 (range: 46–88) years. Mean follow-up period was 125.6 (8–244) months. Of the 62 patients 33 (53.2%) were operated on for BCC and 29 (46.8%) for SCC. Four patients (6.5%) had recurrences during their follow-up. There was no loss of the paramedian forehead flap.

Conclusion: Paramedian forehead flap is a reliable option in the reconstruction of larger defects of the nose even in smokers and elderly patients who have comorbid diseases.

Keywords: Head and neck, basal cell carcinoma, skin cancer, squamous cell carcinoma, surgical excision, reconstructive surgical procedures, pedicled flap, facial plastic surgery

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Introduction

The nose is the part of the face that is most exposed to trauma, sunlight, and other environmental factors. Skin cancers, with increased incidence in the recent years, occur most commonly in the head and neck region, especially in the nasal skin (1, 2). Aesthetic and functional aspects increase the importance of reconstruction in this region after surgical removal of skin tumors, congenital defects, or defects due to trauma.

Although small nasal skin defects can be repaired by primary suturing, skin grafts, rotation or advancement flaps, these methods are not sufficient in larger defects. If the defect contains more than one cosmetic subunit or involves more than 50% of one of the cosmetic subunits, the remaining part of the subunit can be excised and repaired with a paramedian forehead flap (3). Further to its aesthetic importance, the functional significance of the nose also makes repair more difficult in cases of wide defects (full-thickness or cartilage defects). Paramedian forehead flap can be successfully used to repair large defects with the wide tissue support they provide.

The advantages of the forehead area are that the skin is free of terminal hair and quite thick, its color is suitable for the nasal skin, the flap has a strong and wide pedicle, there is strong vascular support, it allows for rotation, and provides wide tissue support. It is usually designed as a supratrochlear artery centered axial flap (4-6).

In this study, we retrospectively investigated the success of paramedian forehead flap in the repair of wide nasal defects and present our twenty-year results.

Methods

All procedures that we performed in the study adhered to the ethical standards of the institutional and/or national research committee and of the Declaration of Helsinki and its subsequent amendments or comparable ethical standards. The study was approved by the Ege University Research Ethical Committee (decision no: 21-8T/17, Aug 26, 2021).

Out of 69 patients who were operated on for nasal skin basal cell carcinoma (BCC) or squamous cell carcinoma (SCC) and underwent paramedian forehead flap repair between 2000 and 2020, 62 whose follow-ups were done in our clinic were included in the study. Data on the follow-up periods, patients' age and gender, tumor types and diameters, and surgical procedures were obtained retrospectively from patient files and histopathologic examination results. Additional diseases such as diabetes, hypertension, and coronary artery disease that could affect the success of the flap were noted.

Most of the patients were treated in two sessions. The first session involved flap design and flap application, the second session involved repairing contour irregularities and cutting the pedicle. Patients with aggressive tumors and large defects were operated on in three stages. The first stage involved tumor excision and advancement flap, if necessary, the second stage involved flap design and flap application, and the third stage involved repairing contour irregularities and cutting the pedicle. All tumor excisions of all patients were done under general anesthesia, and the second and third stages were done under local anesthesia.

The paramedian forehead flap is a pedicled axial flap supplied primarily by the supratrochlear artery. The flap was designed by marking the midline of both eyebrow lines, the glabella, and then advancing 2 cm (1.7–2.2) laterally to mark the supratrochlear artery (Figures 1, 2). Then, depending on the shape of the defect, either a mold was created using a suture foil or the flap was shaped based on measurement (Figure 3). The incisions were made up to the periosteum and dissection was performed on the supraperiosteal plane. In patients with a full-thickness dorsal defect, auricular composite grafts, skin grafts or septal turn-in flaps were used for mucosal repair and conchal and septal cartilage or costa was used for cartilage repair (Figure 4). In addition, the repair was made with conchal cartilage in all patients with alar cartilage defects. In patients with large defects, a malar advancement was performed first, and the paramedian flap was turned six months later. In cases which tumor infiltration to the nasal bone was identified, the bone was thinned with a burr. The pedicle was cut after five weeks in all patients (Figure 5). Pedicle edges were formed and thinned according to the

Figure 1. Infiltrative basal cell carcinoma in the supra-alar region of the nose. As seen, the lesion is widespread and crusted

Figure 2. Preparing the flap: The midline of both eyebrows was marked and an approximately a 2-cm area was identified as the estimated pedicle region starting from 2 (1.7–2.2) cm laterally

recipient and the donor sites. The wound was sutured with 5/0 polypropylene sutures.

Defect areas were calculated from photographs with a ruler related to the defect shape. In rectangular shaped defects the area was calculated by computing the rectangular area and in circular shaped defects by computing the circle area.

Statistical Analysis

Statistical Analysis was performed using the IBM SPSS (IBM SPSS Statistics for Windows, version 25.0. Armonk, New York, USA). The Shapiro–Wilk test was used for determining the distribution pattern of the data. The distribution of the groups was parametric. Descriptive statistics was used for statistical analysis. Data were expressed as mean ± standard deviation.

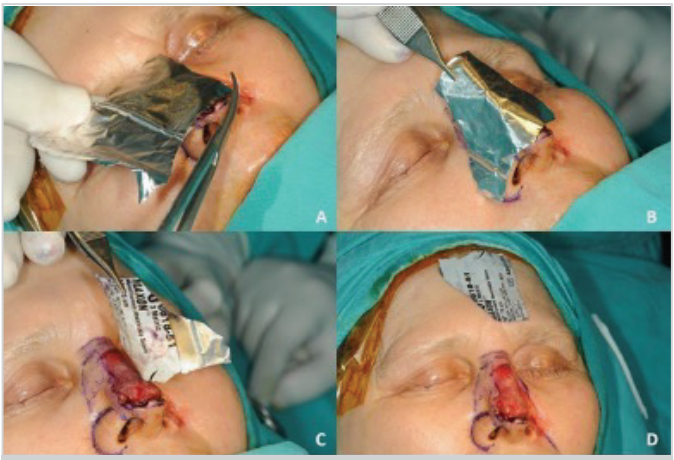

Figure 3. (a-b) Creating template from the intact side using suture foil, (c) modifying template according to the defect area, (d) using template for designing the flap

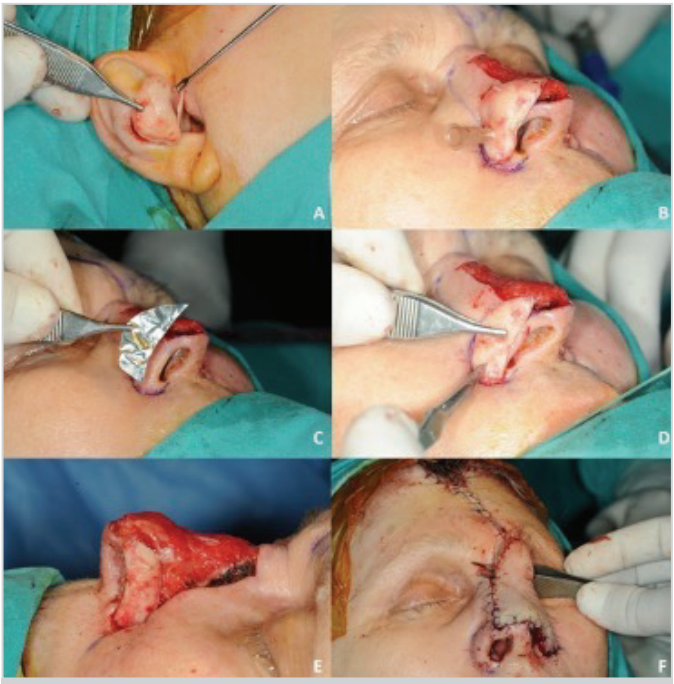

Figure 4. (a) Using the conchal cartilage to reconstruct the alar cartilage, (b-d) shaping the conchal cartilage as an alar cartilage (e) applying the shaped cartilage to the defect area, (f) final status of the flap

Results

Of the 62 patients, 29 (46.8%) were female and 33 (53.2%) were male. Their mean age was calculated as 61.4 (46–88) years. Mean follow-up period was 125.6 (8–244) months. It was shorter than 12 months in 2 patients, 12–60 months in seven patients, 60–120 months in 19 patients, and longer than 120 months in 34 patients. Out of 62 patients 33 (53.2%) were operated on for BCC and 29 (46.8%) for SCC. Among the BCC types, seven (21.2%) superficial, 14 (42.4%) infiltrative, nine (27.3%) nodular, three (9.1%) micronodular subtypes were identified. Four patients (6.4%) had recurrence in their follow-up periods. Of the patients with recurrence, two had BCC (one infiltrative, one micronodular) and two had SCC. One of the BCC recurrences was seen after 22 months, one after 32 months and one of the SCC recurred after 13 months, one after 16 months. Re-excision was performed on patients with recurrence.

When classified according to defect types, eight (12.9%) patients had only skin defects, 36 (58.1%) had skin and cartilage defects, 18 (29%) had full thickness defects. Of the 36 patients with skin + cartilage defect, 23 (63.9%) had both alar cartilage and vestibular skin defect, seven (19.4%) had upper lateral cartilage defect including the overlying skin, and six (11.1%) had both lateral and alar cartilage defect. In the full thickness group, five (8.1%) patients had septal defect, and four (6.5%) had nasal bone defect.

Inner lining was performed with skin grafts in three (4.8%) patients, with septal turn-in flaps in 13 (21%) patients and with composite grafts in two (3.2%) patients. The

Figure 5. View of the patient eight weeks after pedicle cutting and 13 weeks after the first operation

cartilaginous framework reconstruction was performed with conchal cartilage in 34 (54.8%) patients, with septal cartilage in 13 (21%) patients, both septal + conchal cartilage in six (9.7%) patients and costal cartilage was used in one of these patients.

The operations were performed in two sessions in 50 (80.6%) patients and in three sessions in 12 (19.4%) patients. Because the defect was very wide in three (4.8%) patients, a malar advancement flap was used and waited for six months before the defect was repaired with a paramedian forehead flap.

Dehiscence was seen in three patients in the frontal donor site. All of these patients were smokers. All patients showed improvement in the recipient site without complications. No complications were seen in the cartilage donor ear in any of the patients from which conchal cartilage was taken. No flap necrosis was seen in any of our patients.

Thirty-four patients (54.8%) had hypertension, 17 patients (27.4%) had type 2 diabetes, and six patients (9.7%) had coronary artery disease. Forty-two patients (67.7%) had hypertension and diabetes comorbidity, and 45 patients (72.6%) had hypertension, diabetes, and coronary artery disease comorbidity. Twenty-four patients (38.7%) were smokers.

Discussion

The nose is an important aesthetic unit of the face, and its defects can lead to aesthetic and functional impairments. Nasal skin defects usually occur as a result of tumor surgeries. Secondary healing or primary suturing may be preferred for narrow nasal skin defects. However, there are basically two methods for repairing larger defects, namely, grafts or local flaps. Although both techniques have their own advantages in small defects, the paramedian forehead flap can be successfully applied on wide nasal defects. The success rates of other flaps remain lower than those of the paramedian forehead flap, especially in large defects (7). It is also more successful than other flaps in repairing full-thickness or containing more than one subunit nasal defects (8).

Paramedian forehead flaps can be performed in two or three stages according to the surgeon experience and patient's condition (9-10). In our study, the operations were done in two or three sessions. In patients who have aggressive tumors with large defects, a malar advancement can be performed and then paramedian forehead flap can be performed six months later. This method can provide two benefits. The first is that the defect area may become smaller as time passes, and the second is that it is easy to follow up for early recurrence of aggressive tumors. In our study we used this approach in three (4.8%) patients.

The risk of developing non-melanoma skin tumor recurrence after surgical treatment is less than 5% (11, 12). This rate may increase depending on the size, subtype, and depth of invasion of the tumor. In our study, which included large nasal skin defects and a heterogeneous patient group, recurrence was seen in a total of four patients (6.4%) and this rate were found similar to those reported in the literature.

In general, failure rates in interpolated flaps are reported as 1–6% (13, 14). The facts that the rate of accompanying diseases is high, the average age is high, but that despite this, none of our patients have had flap necrosis suggests that paramedian forehead flaps can be used very reliably in this age group. Still, although there are many studies on the repair of nasal defects, factors affecting flap success, causes of complications and flap success rates are not clear.

There is no clear consensus in the literature on the effect of comorbid diseases on flap success, especially of diabetes mellitus. Some studies found no statistically significant correlation between diabetes and flap success (13). There are studies proving that successful flap division could occur within 1–2 weeks despite any underlying comorbidities (15). In our study, the absence of flap necrosis in any of the patients indicates that with strong and sufficient vascular support, it can be successfully used even in full-thickness defects. The absence of flap necrosis even in patients with additional diseases such as hypertension and diabetes supports this.

Theoretically, the cartilage support applied under the flaps can disrupt flap neovascularization, which can affect flap success (14). The fact that the end borders of the flap especially need this neovascularization makes it even more important. Nutrition by neovascularization is not important until the pedicle is cut. However, in our study, the fact that no flap necrosis was observed in any patient before or after the pedicle was cut, even in patients with additional diseases, suggests that cartilage support can also be safely used with these flaps and that cartilage used for support does not impair flap nutrition. In addition, cartilage necrosis was not detected in patients in whom cartilage was used, as far as could be seen in the second and third sessions.

As the thickness and size of the defect increase, flap success rates can decrease (4). This is caused by insufficient vascular support, especially at the borders of the flap. Also, as flap thickness increases, nutrition by neovascularization may not be sufficient. However, in our study, the absence of necrosis and complications in flaps used in both full thickness and partial defects suggests that these flaps can be reliably used in both partial and full-thickness defects.

The most common complication and important condition affecting flap success is wound site infection (16). Flap necroses secondary to infection are frequently encountered. Particularly in full-thickness defects, the direct encounter of

the flap with the nasal cavity and nasal flora increases this possibility. However, the fact that no wound site infection or flap necrosis due to infection occurred in any of the patients in our study may be due to the strong vascular support of these flaps.

Smoking is another factor affecting flap success. Smoking has been shown to reduce flap success in previous studies (13, 17, 18). However, the complete flap success in smokers in our study may be due to the fact that the supratrochlear artery, which constitutes the main vascular support of these flaps, is strong and resistant to occlusion. But it is also clear that there is a need for studies with higher numbers of patients. Although smoking has not been shown to reduce flap success in our study, dehiscence was seen in the frontal donor site in three patients and all of these patients were smokers. Thereby we can say that smoking actually reduces overall success.

The first limitation of our study is its retrospective design. The second limitation is the lack of a scale indicating the quality-of-life index of the patients. Further studies are necessary to analyze the factors associated with possible complications, such as measures of the subjective evaluation by the patient and re-analysis of arguments with longer case series.

Conclusion

Because aesthetic and functional aspects of the nose increase the importance of defects in this region, appropriate reconstruction of the skin defects of the nose related to tumor surgery, congenital defects or trauma is essential. Paramedian forehead flap is a reliable option if defects contain more than one subunit and in full thickness defects even in smokers and elderly patients who have comorbid diseases.

Ethics Committee Approval: All procedures that we performed in the study adhered to the ethical standards of the institutional and/or national research committee and of the Declaration of Helsinki and its subsequent amendments or comparable ethical standards. The study was approved by the Ege University Research Ethical Committee (decision no: 21-8T/17, Aug 26, 2021).

Informed Consent: Informed consent was obtained from all individual participants included in the study.

Peer-review: Externally and internally peer-reviewed.

Authorship Contributions

Surgical and Medical Practices: F.A., İ.K., Concept: F.A., İ.K., Design: F.A., İ.K., Data Collection and/or Processing: İ.K., M.U., V.B., Analysis and/or Interpretation: M.U., V.B., Literature Search: V.B., Writing: M.U., V.B.

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Main Points

• The paramedian forehead flap is ideal reconstructive choice in many patients and can be safely and reliably performed even in smokers and elderly patients who have comorbid diseases.

• Because of low donor site morbidity and good tissue match outstanding functional and cosmetic results can be achieved.

• The flap can be completed in 2 or 3 stages, depending on the patient's defect, comorbidities, and patient expectations.

• Our forehead flap success and complications rates were found to be similar to the rates in the literature.

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