Annals of Medical Research
DOI: 10.5455/annalsmedres.2019.01.051 2019;26(4):703-6

Original Article

A paramedian forehead flap based on the axial artery and vein for nasal defects

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Abstract

Aim: The paramedian forehead flap is the first choice for reconstructing nasal defects when local tissue is insufficient. Arterial supply to the flap is based on the supratrochlear and supraorbital arteries. Venous drainage from the flap has been a neglected area in the planning of a forehead flap. In this study, a paramedian forehead flap was planned to include the supratrochlear artery and vein for nasal defects.

Material and Methods: This retrospective study included 17 patients (11 males and 6 females) with a mean age of 59.47 years (range, 45–88 years) who were treated with a forehead flap for a nasal defect between January 2011 and January 2017. All operations were performed under general anesthesia; mean operation time was 95 min.

Results: The forehead flap was transferred in two stages in 11 patients and one stage in 6 patients. Bleeding from the flap edge and congestion were less frequent in our forehead flaps than a conventional forehead flap. No flap was lost in any patient.

Conclusion: Venous insufficiency may result in loss of the forehead flap; therefore, including the vein may reduce potential flap loss.

Keywords: Paramedian Forehead Flap; Supratrochlear Artery; Supratrochlear Vein; Nasal Defect.

INTRODUCTION

The origins of forehead rhinoplasty (Indian method) are obscure but it has been performed in India (1-3). The first text about nasal reconstruction was written by Sushruta-Samhita, in which the surgeon Sushruta provided a description of the nasal reconstruction technique (4). The classic Indian forehead flap, including the supraorbital and supratrochlear vessels as the pedicle, also includes the mid-portion of the forehead (1,3). Over time, refinements in the design of the flap were developed. The central forehead tissue is transferred on a unilateral paramedian blood supply (5). McCarthy et al. demonstrated that the forehead is perfused by a vessel arcade that includes the supratrochlear, supraorbital, infraorbital, dorsonasal, and angular branches of the facial artery (6).

The best donor site option for nasal reconstruction is nasal skin and nasal mucosa, but only small nasal defects can be closed with nasal flaps (7). The forehead and nasolabial regions are the first choice for nasal reconstruction if nasal tissue is insufficient (8), as the skin of the forehead closely matches the skin of the nose in both colour and texture (9,10).

The forehead flap is planned based on arterial circulation, which originates from the supratrochlear artery. This artery is localized in the medial part of the eyebrow at the level of the superior orbital rim (11,12). The forehead flap is an axial flap but it has an artery but no axial vein. Therefore, venous congestion and bleeding from the edge of the flap are seen particularly during the early postoperative period in almost all patients. Although partial loss of the flap is rarely seen (13-15), loss of the flap may be associated with venous congestion rather than arterial insufficiency.

We present a series of 17 patients treated with a paramedian forehead flap that included both the axial vein and artery.

MATERIAL and METHODS

This study included 17 patients (11 males and 6 females) with a mean age of 59.47 years (range, 45–88 years) who were treated with a forehead flap for a nasal defect between January 2011 and January 2017. A subcutaneous pedicle was planned for five patients who had a caudal nose defect. All operations were performed under general anesthesia; mean operation time was 95 min. The excision

Received: 27.01.2019 **Accepted:** 23.02.2019 **Available online:** 05.03.2019
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margin varied from 0.5 to 1.0 cm depending on the tumor type. Four patients had full-thickness nasal defects. The nasal lining was reconstructed with a nasolabial island flap in three patients and a contralateral septal mucosal flap in one patient. The supporting framework was re-established with a conchal cartilage graft in five patients (Table 1).

Table 1. Summary of the characteristics of the 17 patients who underwent nasal reconstruction with the forehead flap which included the supratrochlear artery and vein

Case No	Age	Gender	Etiology	Localization	Pedicle
1	56	Male	BCC	Dorsum	Subcutaneous
2	65	Male	SCC	Side Wall	Cutaneous
3	49	Male	BCC	Tip, Dorsum	Cutaneous
4	71	Male	BCC	Side Wall	Cutaneous
5	88	Female	BCC	Tip, Dorsum Side Walls	Cutaneous
6	62	Male	BCC	Side Walls	Cutaneous
7	54	Male	SCC	Tip, Dorsum	Cutaneous
8	45	Female	BCC	Tip, Dorsum	Cutaneous
9	67	Male	BCC	Dorsum Side Walls	Cutaneous
10	51	Female	BCC	Dorsum	Subcutaneous
11	68	Male	BCC	Tip	Cutaneous
12	55	Female	AK	Dorsum	Subcutaneous
13	61	Male	BCC	Tip, Dorsum	Cutaneous
14	52	Female	BCC	Dorsum	Subcutaneous
15	53	Male	SCC	Side Wall	Subcutaneous
16	48	Male	AK	Side Wall	Cutaneous
17	66	Female	SCC	Tip, Side Wall	Cutaneous

AK; Actinic keratosis, BCC; Basal cell carcinoma, SCC; squamous cell carcinoma

Surgical Procedure

After the defect was created, the supratrochlear (superficial) vein on the medial forehead was marked. The bigger vein was selected if there were two veins. If the supratrochlear vein could not be seen directly, the Valsalva maneuver was performed to make the supratrochlear vein conspicuous. Then the supratrochlear artery was marked on the same medial side of the superior orbital rim using an anatomic landmark. Thus, the pedicle of the forehead flap included both the supratrochlear artery and supratrochlear (superficial) vein. The width of the pedicle was planned to be 1.5–2.0 cm (Figure 1).

The flap was harvested from the distal to the proximal margin and dissected between the frontalis muscle and the periosteum as much as 2.0 cm above the supraorbital rim. Then the dissection was performed under the periosteum. After elevating the flap, it was rotated 180° and sutured to the defect. The flap donor sites were grafted with a full-thickness skin graft from the supraclavicular region in 12 patients and repaired primarily in 5 patients.

RESULTS

The forehead flap was transferred in two stages in 11 patients. In the first stage, the tumor was excised, and the forehead flap was transferred to the defect. A cartilage graft for framework support was engrafted at this stage, if required. At the second stage, the pedicle was divided, and the superior part of the flap was inserted into the defect. The pedicle of the flap was inserted into the donor area when the eyebrows were asymmetrical and excised when the eyebrows were symmetrical (Figure 1).

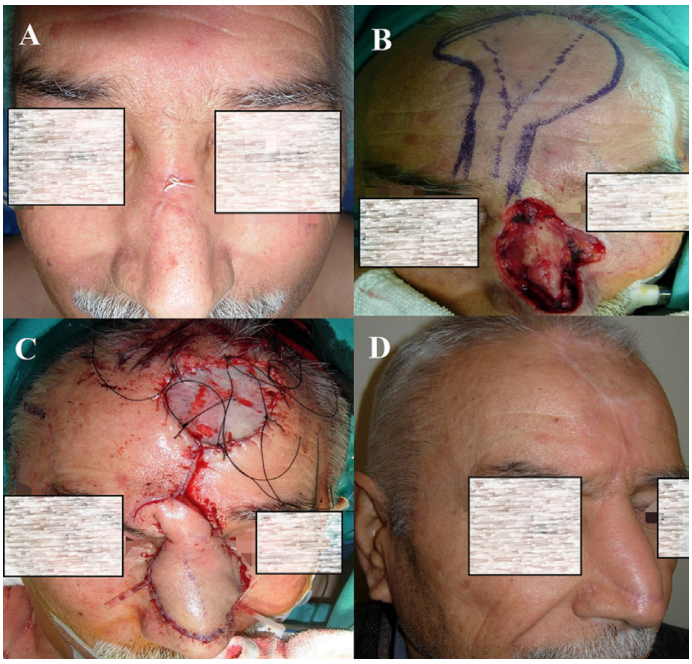

Figure 1 A. A 67-year-old male with squamous cell carcinoma. B. The tumour was excised with a 1 cm peripheral margin. The superficial vein is marked, and the flap and pedicle were planned to include the vein and supratrochlear artery. C. The forehead flap was rotated 180° to the defect and sutured. The flap donor site was grafted with a full-thickness skin graft from the supraclavicular region. No venous congestion or bleeding was observed. D. Postoperative month 15

One-stage reconstruction was performed in patients whose defects were reconstructed with a subcutaneous pedicled flap (Figure 2).

Bleeding from the flap edge and congestion were less frequent in our forehead flaps than typical for a conventional forehead flap. There was no flap loss in any patient. All patients were discharged on postoperative day 1. Three weeks after the first operation, the flap pedicle was divided under local anesthesia.

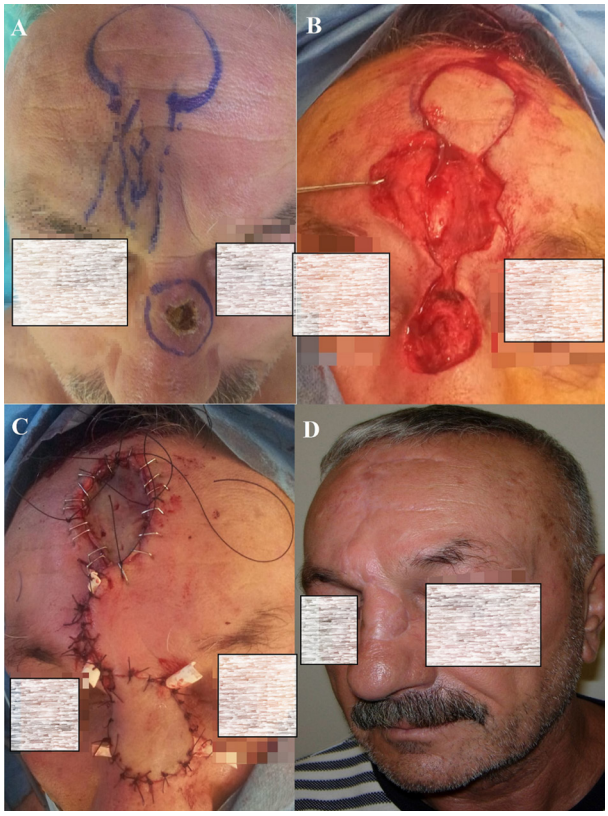

Figure 2 A. A 56-year-old male with basal cell carcinoma on the dorsum of the nose. B. The surgical excision margin was 1 cm. The subcutaneous pedicled flap was planned according to the superficial vein site of the forehead to include the superficial vein and the supratrochlear artery. The tumor was excised. The superficial vein was protected by harvesting the very thin overlying skin. C. The flap was rotated and sutured to the defect. No venous congestion was observed during the early postoperative period. D. Postoperative month 19 after forehead flap reconstruction

DISCUSSION

An axial flap has an anatomically defined vascular pedicle consisting of an artery and a vein. Venous drainage of a flap is as important as arterial flow. Almost all studies about vascular supply to a forehead flap have focused on the artery inflow to the flap; venous drainage of the flap has been neglected (16,17).

The supratrochlear artery has no accompanying vein but has a thin adventitial venous vasa vasorum (18). The supratrochlear vein begins on the forehead in the venous plexus. Two supratrochlear veins run downward near the middle of the forehead. The two veins are joined by the transverse nasal arch at the radix of the nose (19). Likewise, the supratrochlear vein is not accompanied by the supratrochlear artery (Figure 3).

For the forehead flap, which will contain both the artery and the vein, the definition of localization of the vein is more important. Because the localization of the supratrochlear artery is anatomically fixed (10,11). However, the supratrochlear vein is more medially localized than the artery. The horizontal distance from the midline is 16.2 mm to the supratrochlear artery and 9.7 mm to the supratrochlear vein at the level of the superior orbital rim. The distance from the supratrochlear veins is different between the right and left sides (20). The supratrochlear vein is often larger on one side of the forehead or there is no double central vein (21) (Figure 3,4,5).

Figure 3. A superficial vein is usually found in the forehead

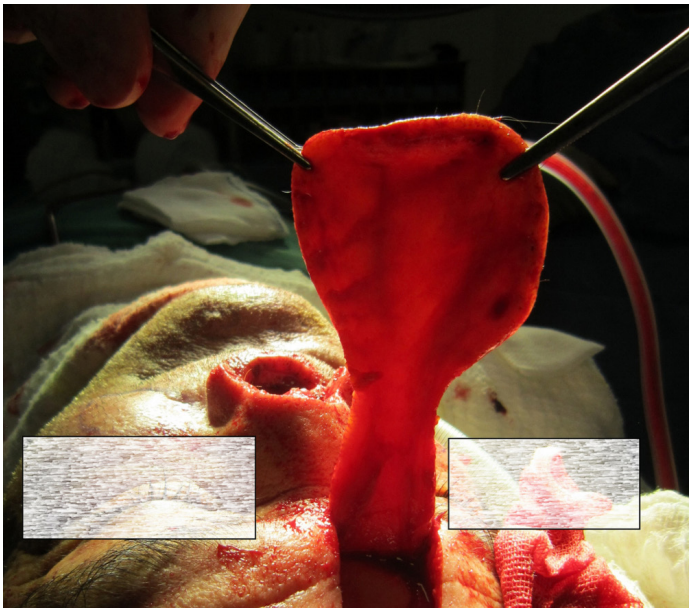

Figure 4. The supratrochlear artery is not accompanied by the supratrochlear vein

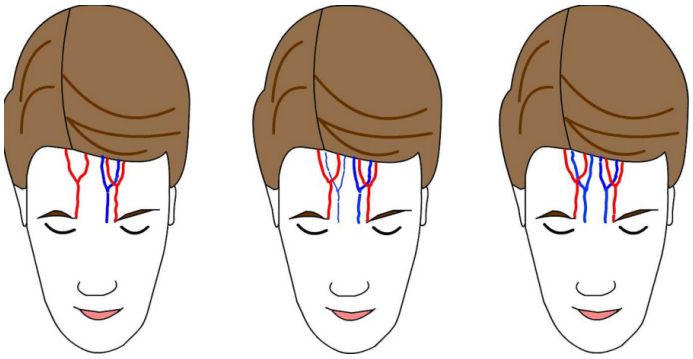

Figure 5. Illustration of venous drainage from the forehead. A. A vein. B. Two veins of different calibre. C. Two veins of the same calibre

Bleeding at the incision edges and a hematoma under a forehead flap that has no axial vein are major problems during the early postoperative period. Bleeding usually stops within 1 day and venous congestion decreases by days 5–7. A forehead flap that includes both an axial vein and artery results in less bleeding and congestion than one that only includes an artery.

Partial necrosis of a forehead flap is uncommon (5.4–9.0%) (13-15). A common problem with forehead flaps is venous congestion. Therefore, partial necrosis of a forehead flap may result from venous insufficiency. Preservation of this vein might improve venous drainage in any flap designed in the glabellar and forehead region.

CONCLUSION

In conclusion, there is usually only one supratrochlear vein in the forehead region; if there are two, one is bigger on one side. The supratrochlear artery exists in each median orbital margin in an anatomically consistent location. In the current study, the supratrochlear vein was detected first, and the flap was planned based on the artery closest to this vein. The supratrochlear vein is easily visualized, particularly in older Caucasian patients. Less venous congestion and bleeding were observed. Necrosis in a forehead flap may result from venous insufficiency. In the current study, no partial or total flap necrosis was observed in any patient. Therefore, the paramedian forehead flap should be planned to include both the supratrochlear vein and artery.

Competing interests: The authors declare that they have no competing interest.
Financial Disclosure: There are no financial supports
Ethical approval: The Ethical Committee of Antalya Education and Research Hospital approved the study protocol (approval number 2017-015).

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