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An alternative single-stage application of the paramedian forehead flap in reconstruction of the face

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ABSTRACT

Background: Paramedian forehead flap represents a workhorse in facial soft tissue reconstruction but always requires a second step in order to interrupt the skin bridge. Direct visualization and dissection of vascular pedicle may avoid this drawback.
Methods: Twenty one patients were treated between January 2012 and January 2014: 6 underwent nasal reconstruction and 15 full thickness defect of medial canthus of an orbital region. The follow-up ranges between 6 months and 2 years. All procedures were carried out in a single stage.
Result: All flaps were performed in a single-stage procedure, survived and healed uneventfully.
Conclusion: The authors describe a refinement of the original technique to be reserved for cases where vessels could be identified by Doppler, consisting in the direct visualization and dissection of the initial tract of the vascular pedicle, thus providing an extremely mobile pedicle whose size allows to locate the first part of the pedicle in the nasion, tunneling under a skin bridge between the emergence of the vessels and the defect.

1. Introduction

Paramedian forehead flap is still one of the most popular flaps for repair of full thickness defect of the nose, the eyelid and the cheek, although the nose reconstruction remains a specific indication.

It is an evolution of the median forehead flap widely used since 700 BC when it was known as “Indian flap”, and reduces the morbidity of the donor site (Whitaker et al., 2007). The supratrochlear perforator flap is a recent refinement of the original technique which further improves the outcome in the donor area and allows a single surgery stage because, as a propeller flap, a skin bridge containing the vascular pedicle and secondary surgery are unnecessary (Geddes et al., 2003).

Although paramedian forehead flaps by subcutaneous pedicle have been already described in literature, we present a further modification consisting of a flap with a very narrow pedicle in its initial tract based on the direct visualization and dissection of the emergence of the vessels thus permitting its localization in the nasion avoiding deformities. Furthermore this allows reducing delayed and secondary procedures as well as debulking and has a very low morbidity in the donor site.

2. Materials and methods

In the preparation of the manuscript the authors have adhered to the STROBE guidelines.

Inclusion criteria: partial nose reconstruction, medial aspect of orbital reconstruction, traceable Doppler signal, patients' specific demand of single-stage procedure – patients refuse embarrassing delayed “bridging” procedures.

Before surgery, all patients were informed about the different reconstructive procedures including the multi-step choice. All advantages and disadvantages were preventively discussed.

2.1. Surgical technique

In cases of compliant patients, the procedure can be performed under local anesthesia. The first step consists of the identification of emergence of the pedicle at supratrochlear notch by a handled Doppler probe. Once identified, the supratrochlear artery is followed upward marking its course on the skin. A custom-made template is tailored on the defect and transferred onto the donor area. The skin flap is designed in the forehead taking into account

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that the skin island should be placed at a distance from the pivot point, namely the emergence of the artery from the supratrochlear notch, compatible with the location of the defect. The greater the distance of the area to be reconstructed from the pivot point, more cranially the flap will be designed. The first tract of pedicle dissection is performed under direct visualization using a 3.5× loupe magnification so as to obtain a narrow initial pedicle up to 1–1.5 cm long to permit its localization in the nasion avoiding deformities. Dissection must take into consideration comitantes veins present. Usually dissection of the pedicle does not include the covering skin; if present it must be removed. Afterward, the dissection of the pedicle continues upwards as a traditional subcutaneous pedicle: as long as the dissection proceeds cranially the amount of soft tissue surrounding the vessels should be wider to include as much vascular network as possible. The cranial portion of the skin paddle can be defatted and thinned carefully. However more aggressive thinning can be safely done at a later stage. In order to prevent any compression or kinking of the pedicle, it is mandatory to release any fibrous bands of the surrounding tissue at the level of the pivot point. In addition, when the skin bridge between the supratrochlear notch and the skin island to be harvested is not too wide, a meticulous subcutaneous dissection of the pedicle may be performed leaving intact most of the skin surrounding the pedicle, with the advantage of reducing the length of the vertical frontal scar, thus improving the esthetic result. Once the pedicle is fully dissected and the skin pad raised, the perfusion of the skin is checked and the flap may be transferred. A wide subcutaneous tunnel allows a safe transfer of the flap to the recipient area. This mini invasive approach allows a direct closure of the donor site with subsequent irrelevant horizontal scar.

3. Results

Twenty one patients aged between 22 and 68 years have been treated in the last two years according to the described procedure. The flap has been used to cover defects of the nose in 6 cases and full thickness defect of medial canthus of an orbital region after basal cell carcinoma in 15 cases. The follow-up ranges between 6 months and 2 years. All flaps survived and healed uneventfully. All flaps were performed in a single stage, no secondary procedures were required. There were no major complications in either the donor or the recipient area, except for a transient venous congestion in one case which resolved itself spontaneously in three days. In all cases of nasal reconstruction cartilaginous frameworks have been used taken from the septum and concha cimbae; the procedures have been used to repair loss of substance involving the entire nasal pyramid in one case, the entire nasal lobule in 3 cases or part of it in other two cases. The repairs of the 15 cases of medial canthus ranged in size from 1 up to 3.2 cm in diameter. In all cases of nostril reconstruction, conformers were used to avoid retractions during the first 6 months post-operation.

4. Discussion

Paramedian forehead flap is an axial perforator flap based on the supratrochlear vessels which emerges from supratrochlear foramen. Supratrochlear artery is a terminal branch of ophthalmic artery which exits the orbit superior of the medial canthal ligament, enters the glabellar region and exits the supratrochlear notch, medially to the supraorbital artery, approximately 2 cm from the midline, and then courses cranially beneath the frontalis muscle accompanied by venae comitantes and nerve. As pointed out by several anatomical studies, the main trunk of supratrochlear artery, once exited from supratrochlear notch, travels under the orbicularis oculi muscle, over the corrugator muscle for a while, and then gradually becomes shallow during the course of traveling upward. It moves supero-medially, traveling subcutaneously in the fat tissue over the frontalis muscle during almost the whole course. The terminal branch of the supratrochlear artery is a muscular branch that travels under the frontalis muscle, only in a minority of cases, once the corrugator muscle has been overcome, the artery directly supplies the skin without any muscular branch. After perforating the depressor supercilii muscle, from the main artery several small branches rise interconnecting each other with the dorsal nasal branches forming a rich microvascular network over the glabella (Skaria, 2015). Although the blood supply for conventional paramedian forehead flap in this area allows a great flexibility in flap design, the use of this flap often requires delayed procedures especially for nasal reconstruction. Unfortunately after flap transposition, bridging of the pedicle from the radix of the nose to reach the more distal part of the recipient area is required, and must be left exposed for at least 3 weeks. This condition is uncomfortable for the patients because of social embarrassment due to unacceptable cosmetic appearance and need of secondary surgery that could be refused by some patients. Several dressings are necessary during the entire delay period. Even for the narrowest pedicles, wide undermining of the forehead is often required to allow the primary closure of the donor site. The tension of the advanced flaps often results in a poor cosmetic scar quality (Menick, 2002, 2012; Rohrich et al., 2004).

In 2009 Mutsumi Okazaki et al. proposed an expanded paramedian flap, including the frontal muscle and the supraorbital artery performed in two surgical steps to increase the freedom of the flap (Okazaki et al., 2009). Later Kazuo Kishi et al., in 2012, proposed to enlarge the arch of rotation through an intraorbital transection of the supratrochlear artery and centering the paramedian forehead flap on the vascular connections among the supratrochlear-angular-and- dorso-nasal artery around the medial canthus, which may be compromised in case of major facial traumas reducing the vitality of the flap (Kishi et al., 2012).

Fig. 1. Intra-operative view of the harvested flap showing the dissected pedicle with a narrow size especially in its initial tract.

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