Soft-tissue defects of the nose after tumor resection, trauma, or infection, which cannot be closed primarily, are always a challenge for the reconstructive surgeon. For satisfying aesthetic and functional results, it is necessary to use surrounding skin with similar semblance, which precisely restores and imitates missing parts with its outlines.

There is a great variety of local flaps in the armamentarium to treat such defects, like transposition flaps, bilobed flaps, rotation flaps, or distant flaps like the forehead flap. The most challenging areas to reconstruct on the nose are the nasal tip and the ala of the nose. This applies particularly for defects that lie close to the vestibulum of the nose or the alar rim. If local flaps, like a transposition flap, a bilobed flap, or a rotation flap, are used to cover such defects, the results from the aesthetic point of view are quite often disappointing. Depending on the flap design, the kind of blood supply, and the functioning of the venous and the lymphatic drainage, there might be prolonged venous congestion and lymphedema, which often might lead to chronic courses. Local flaps just based on small subcutaneous pedicles are of higher risk for such kind of complication.

Another problem might be the distortion of the nasal tip or the ala of the nose after flap transfer because of the resulting one-sided tension.

The use of perforator flaps for nasal reconstruction has been widely accepted and proven to have significant advantages compared with local flaps with random vascularization. In 2015, Xu et al presented an “oxhorn”-shaped V/Y-perforator flap from the alar groove, based on the dorsal nasal artery in 20 patients. The authors performed a wide cephalad dissection including the superficial muscular aponeurotic system (SMAS) extending an incision into the cheek. Defects up to 2 x 1.8 cm were repaired by this technique. Apos tolou and Niranjan (2016) discussed this work. They proposed a V/Y-perforator flap along the anticipated course of the lateral nasal artery for reconstruction of nasal tip and alar defects providing good aesthetic results. (Plast Reconstr Surg Glob Open 2017;5:e1195; doi: 10.1097/GOX.0000000000001195; Published online 30 January 2017.)

Background: The ala of the nose is vascularized by a dense net of perforators originating from the lateral nasal artery or the angular artery. These vessels reach the ala in a cascade fashion from the alar groove/lateral nasal wall. Based on these vessels, a V/Y flap can be dissected with a wide range of mobility.

Materials and Methods: Nineteen patients underwent reconstruction of the nose by means of a V/Y-alar-perforator flap alone or in combination with a myocutaneous rotation flap from the lateral nasal wall and/or from the nasal dorsum for reconstruction of defects at the nasal tip, ala of the nose, and/or lateral nasal wall. All patients were followed up 8 months after surgery in average.

Results: There was no prolonged congestion or any tissue loss. All patients presented postoperatively with excellent aesthetic results, and no nasal distortion was observed.

Conclusion: The V/Y-alar-perforator flap alone or in combination with a myocutaneous rotation flap proved to be a reliable tool in the armamentarium for reconstruction of nasal tip and alar defects providing good aesthetic results. (Plast Reconstr Surg Glob Open 2017;5:e1195; doi: 10.1097/GOX.0000000000001195; Published online 30 January 2017.)
In the present cohort, we describe a V/Y-perforator flap from the inner ala of the nose, which can be used solely or in combination with a myocutaneous rotation flap from the lateral nasal wall and/or from the nasal dorsum to cover small size defects of up to 2.5 cm in diameter. The vascular basis of the V/Y-alar perforator flap in the present study is the small perforator reaching the inner ala of the nose in a cascade fashion (Figs. 1, 2). They emerge from the lateral nasal artery or from the angular artery. As vascular injection studies have proven, there exists a dense network of these arterial perforators, supplying the ala of the nose. These perforators are constantly present and therefore make this kind of perforator flap very safe. Based on this anatomical knowledge, part of the nasal alar skin can be used for reconstruction of adjacent skin defects.

**MATERIALS AND METHODS**

The present prospective descriptive cohort study was performed at the Institute for Reconstructive Aesthetic Surgery in Zurich from 2013 until 2015. All cases had a nonmelanoma skin cancer of the nose tip or the nose ala. Depending on the nature of the lesion (basal cell carcinoma; nodular or morphea; squamous cell carcinoma), a resection margin of 2 to 5 mm was performed. The resulting defect had a diameter of up to 25 mm. The reconstruction was performed as a one-stage procedure.

**Operative Technique**

The procedure was performed in local anesthesia and intravenous sedation. The flap design is based on 3 principles: (1) aesthetic subunits of the nose (extending the defect to the aesthetic unit boundary); (2) the relaxed skin tension lines (choosing the line of incision when the defect compromises more than 1 subunit); and (3) the vascularity of the nose ala. The vascular supply of the V/Y-perforator flap is based on the outer and subcutaneous sides of the “V,” where the alar perforators run toward the ala (Fig. 1), in opposite to the conventional V/Y flap, whose vascularity lies in the sliding subcutaneous tissue below the “V.”

Briefly, the tumor margin is marked including the line of incision of flap to be prepared. The top of the V-body always lies adjacent to the defect. If the tumor is located along the ala of the nose, the V/Y flap originates also from the ala (Figs. 1, 5), either from the basic part or from the cephalic part of the ala (we call it mirror reversed; Table 1). When the tumor is located at the nasal tip, the V/Y flap originated from the cranial part of the ala of the nose (Fig. 4). In the other cases, the V/Y flap originates from the alar groove (Fig. 6).

When dissecting this flap, it is important to stay strictly directly under the dermis at the subdermal level, and care has to be taken not to injure the soft tissue (subcutis and muscle) below; the perforators are located at this level. During dissection with loupe magnification, these vessels can be seen glancing through. The bottom of the pedicle is then dissected immediately on top of the perichondrium or above the mucous membrane. The pedicle includes the layer between the dermis and the perichondrium or mucous membrane and contains the alar perforators. During the dissection, it is mandatory to carefully spare the soft tissue surrounding the perforators because otherwise there is the risk of damaging the lymphatics. After complete dissection of the pedicle, the body of the V can be shifted up to 90-degree without tension toward and into the adjacent
defect (Figs. 1B, 3B). If defect closure is incomplete, an additional myocutaneous rotation flap from the lateral and/or dorsal nose is prepared and transferred into the defect (Figs. 2, 4–6). To optimally reduce the tension at the tip of the rotation flap, 1 single subcuticular suture is placed along the longitudinal incision line approximately at the middle third of the flap, using long-term monofilament synthetic absorbable suture 5-0 (Maxon, Polyglyconate; Covodien, Medtronics, Minneapolis, Minn.). With this maneuver, the proximal part of the dissected flap surface is pulled toward the defect, and therefore, the inset of the flaps distal part is tension reduced.

Final closure is achieved by some single knots and using a running cutaneous suture 7-0 (Prolene 7-0; Ethicon, Norderstedt, Germany). Dressing is applied with fusidic acid/betamethasone cream (Fucicort Cream; Leo Pharma, GmbH, Neu-Isenburg, Germany), with a combination of antibiotic and a corticosteroid applied with a cotton wool plaster. The stitches are removed 1 week postoperatively, and the suture lines are covered by adhesive strips (Steri-Strips; 3M, Minn.) for another week.

All patients were followed up by the surgeon the first day and the first week, the third and the sixth week, and then the third until the eighth month or later after surgery. The patients were instructed to use a sun blocker for the operated skin continuously over 6 months and to frequently apply pressure during the first 3 weeks after the operation.

Data Collection and Analysis

Photographic standard documentation before and after surgery was performed. The degree of flap shift (angle...
of advancement) and visibility of the perforators were documented (Table 1). Complementary surgical procedures such as the myocutaneous rotation flap and complications were recorded. Patients with a follow-up of at least 8 months were included in the study.

RESULTS

Nineteen patients (11 females; 8 males) were included into the study (Table 1). The patient’s age ranged from 45 to 82 years (mean age, 63.3 years). Seventeen patients had a basal cell carcinoma, and 2 patients had a squamous cell carcinoma. The patients were followed up in average in a time span of 8 months.

The tumor was localized in 13 patients in the nasal tip (13/19) and in 6 patients (6/19) in the ala of the nose. In 1 case of those (1/19), the nose tip and the alar groove and the lateral wall of the nose were involved (Fig. 6). The size of the defect measured 2.5 cm in diameter.

In 4 patients with a tumor at the nasal tip (4/13), a V/Y-alar-perforator flap was performed. In the other 9 cases (9/13), a combination of the V/Y-alar-perforator flap with a myocutaneous rotation flap from the lateral nasal wall and/or dorsal nose was performed. Patients with tumor involvement of the ala (6/19), with exception of 2 cases (Figs. 5, 6), had a singular V/Y-alar-perforator flap. In 2 of these patients (2/6), the flap was designed as a reverse mirrored flap with the “V” pointing to the base of the ala. In case numbers 10 and 11 (Figs. 5, 6, respectively), an additional myocutaneous rotation flap from the lateral nasal wall and an additional myocutaneous rotation flap from the nasal dorsum were performed, respectively.

In Figures 3 to 6, 4 patients are presented, each with a different defect location: (1) involvement of the lateral nasal wall/supratip (edge of the tip; Fig. 3); (2) involvement of the central nasal tip (Fig. 4); (3) involvement of the ala of the nose (Fig. 5); and (4) involvement of the ala, alar groove, and lateral nasal wall (Fig. 6).

The surgical procedure was uneventful in all cases. In 11 of the 19 dissections, the perforator vessels could clearly be seen without loupe magnification (Table 1; Fig. 4). A wide range of angle shift of the advanced V/Y flap up to 90-degree angle was achieved (Table 1). All flaps remained vital.

After the third week, there was no lymphedema nor prolonged venous congestion. After the third month, there were no suspicious scars. In all patients, the function of the nose and the aesthetic of the nasal form could be well preserved. Corrective procedures were not necessary. All patients were satisfied with the result.

DISCUSSION

As introduced by Blasius in 1848, the “V/Y flap has gained popularity in closing soft-tissue defects at all parts of the body by sliding a subcutaneous random pattern flap from tissue adjacent to the defect. This technique has widely been used for nose reconstruction, particularly for defects of the nose dorsum and also for nostril by advancing adja-
Fig. 4. A, Sixty-three-year-old female patient: basal cell carcinoma of the central tip. She had already several skin excisions on the right side and dorsum of the nose, including the ala (inverted). Surgical markings. B, Dissection of the V/Y-alar-perforator flap from the left side and myocutaneous rotation flap from the nasal dorsum. One of the perforator vessels is clearly visible. C, Nine weeks postoperatively, frontal view. D, Lateral view: the exact nasal lining and symmetry of the nose remained.

Fig. 5. A, Seventy-year-old male patient. Several years after conservative treatments of a basal cell carcinoma of the right ala of the nose (with retraction of the alar rim): surgical markings. B, V/Y-alar-perforator flap from the lower half of the ala and myocutaneous rotation flap from the lateral nasal wall have been performed: after flap dissection and final closure. C, Seven months postoperatively, frontal view. D, Lateral view: the exact nasal lining and symmetry of the nose remained.
cent soft tissue, thereby achieving wound closure while minimizing tension.\textsuperscript{20-22} The advantage of this technique is that color and texture perfectly match because adjacent soft tissue is used. Another advantage of this design is the ability to close the secondary defect primarily. A disadvantage is the very limited arc of rotation and mobility, which is dependent on the laxity of the underlying subcutaneous tissue. This is the case if the V/Y flap originates from the ala of the nose, where a marked rigidity between the skin and the underlying cartilage is present and where practically no tissue advancement is possible without distortion of the ala rim.

In the present cohort, the versatility of a perforator V/Y flap was proven by a wide range shift angle of an advancement of up to 90-degree angle, and the feasibility to incorporate a myocutaneous rotation flap to allow the repair of defects of up to 2.5 cm of the nose tip, supratip, ala and lateral nasal wall at 1 stage. Niranjan et al\textsuperscript{23} (2000) and Yildirim et al\textsuperscript{24} (2007) showed a wide arc of rotation and mobility of V/Y flap prepared on a perforator vessel for the repair of defects in different areas of the body. Recently, Apostolou and Niranjan\textsuperscript{11} (2016) proposed V/Y perforator flap for nose-tip reconstruction in 1 case providing encouraging results. This flap was proposed for defects of up to 1.6 cm, and no complementary flaps for defects of more than 1.6 cm were proposed.

The lateral nasal artery, a branch of the facial artery/angular artery, gives, in a cascade form, several branches to the ala of the nose, which supply several little perforators to the skin of the ala (Fig. 1). Constantian\textsuperscript{25} (1998) showed that a V/Y flap based on perforators from the ala base can be safely used for the reconstruction of nostril and vestibular stenosis. A perialar-crescentic flap, adjacent to the alar base, is transposed on the subcutaneous and musculocutaneous perforators toward the nose entrance and the vestibulum.\textsuperscript{25}

The presented V/Y-perforator flap shows a remarkable arc of rotation and mobility designed to cover soft-tissue defects of the nasal tip, the lateral nasal wall, or the ala itself. Especially, the closure of defects close to the nasal vestibulum or defects close to the alar rim is suitable because the tension vector pulls vertically and not horizontally after flap transfer. Therefore, there will be no distortion of the alar rim. Because of the subdermal dissection toward the lateral nasal wall during preparation of the pedicle, the skin is already detached and the defect can be closed without remarkable tension. In the present series, no alar rim retraction was observed and no corrective measure was necessary.

In cases where a primary defect closure is not possible by a V/Y-alar-perforator flap, an additional myocutaneous rotation flap dissected from the lateral wall and/or from the nasal dorsum can be used (Figs. 4–6). The advantage herein is that instead of cutting away the Burow triangle, which is needed to complete the flap transfer when using a myocutaneous rotation flap, the “V” of the V/Y-alar-perforator flap correlates with the Burow triangle and is shifted cranially into the defect. With this combination of 2 different flaps, the tension at the location of the defect after transfer of these flaps is minimized, and the tension vectors are neutralized. Therefore, the symmetry of the nasal axis will be achieved. Furthermore, the aesthetic units of the nose can be preserved, which should be the aim for any facial reconstruction.\textsuperscript{26,27}
Lymphedema after the use of local flaps in nasal reconstruction is a worry to the patients and surgeons alike. Random cutaneous transposition, rotation, or bilobed flaps with a small basis often result in long-lasting lymphedema. This is also a concern for distant perforator flaps of the cheek for nose reconstruction as observed in the series published by Karsidag et al28 (2010) and Lombardo et al29 (2016). In our series, we had neither prolonged lymphedema of the V-Yalar-perforator flap nor of the myocutaneous rotation flap. The proposed additional rotational flap to complete the nasal repair should be dissected musculo-cutaneously. This approach optimized the lymphatic drainage and the vascularity of the flap compared with a pure cutaneous/subcutaneous pedicle. A possible explanation for the obtained good lymphatic drainage could be the fact that the lymphatic vessels are arranged in parallel to the perforators, which are preserved.5,20 In consequence, the flap design with axial blood and lymph flow optimizes the aesthetic result and ensures flap survival without prolonged lymphatic or venous congestion. A contraindication for the present technique is a previous surgical procedure immediate or close to the alar groove because of the possible damage of the cascade of alar perforators.

The long-term aesthetic results with inconspicuous scars have also been achieved by placing the incisions along the relaxed skin tension lines in between the aesthetic subunits.

CONCLUSIONS
The V-Yalar-perforator flap extends the armamentarium for nasal reconstruction, especially for defects involving the nasal tip and the ala of the nose. In combination with a myocutaneous rotation flap from the lateral nasal wall and/or from the nasal dorsum, we perfectly could restore the nasal cover for defects of up to 2.5 cm in size. The risk of unpleasant scars, chronic lymphedema, and nasal distortion can be avoided by using this technique.

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PATIENT CONSENT
Patients provided written consent for the use of their images.

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