Superficial Temporal Fascia Pedicled V-Y Advancement Flap for Scalp Reconstruction

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Abstract Repair of scalp defects using local hair bearing scalp is technically challenging. Transposition or rotation of local flaps to close the defect has its own disadvantages. Reconstruction of scalp defect using superficial temporal fascia pedicled V-Y advancement flap using both frontal and parietal branches of superficial temporal artery following the excision of a benign and a malignant pathology is reported here. It is possible to reconstruct the defect with hair bearing scalp in a single stage along with primary closure of the donor site using this technique.

Keywords Hair bearing scalp · Superficial temporal artery · V-Y advancement · Pedicled flap · Direction of hair

Introduction

Restoration of hair bearing area is the primary goal in the reconstruction of scalp defects following surgery, trauma

or burns. Primary closure of the defects is restricted because of unyielding nature of the scalp. Although there are reports of flaps based on the superficial temporal artery [1] and more recently on the occipital artery [2, 3], most are pedicle flaps or island flaps. We have used superficial temporal fascia pedicled V-Y advancement flap using both frontal and parietal branches of superficial temporal artery following the excision of a benign and a malignant pathology and obtained good results both in closing the defect and restoring the scalp hair. We describe our cases in which this procedure was used successfully.

Case Report-I

A 50 year old female reported to our centre for the management of FNAC diagnosed case of basal cell carcinoma, vertex of the head (Fig. 1). CT revealed no bony involvement and a lymph node metastasis. The surgical repair outlined below was used in the case following wide local excision of the lesion using superficial temporal fascia pedicled V-Y advancement flap containing both frontal and parietal branches of superficial temporal artery. The size of the defect was 75 mm in diameter (Fig. 2). The flap survived completely with no partial necrosis or baldness (Fig. 3). The postoperative scar was inconspicuous because the suture line lay at right angles to the direction of hair (Fig. 4).

Case Report-II

A 15 year old female referred to our centre from the department of dermatology for the management of a Nevus sebaceous scalp on the parietal region (Fig. 5). The surgical repair outlined below was used in the case following wide local excision of the lesion using superficial temporal fascia pedicled V-Y advancement flap containing only parietal

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Fig. 1 A non healing ulcer on the vertex of the head

Fig. 3 Postoperative survival of the flap

Fig. 2 Size of the defect

Fig. 4 Inconspicuous scar after 6 months

branch of superficial temporal artery. The size of the defect was 50 mm in diameter (Fig. 6). The flap survived completely with no partial necrosis or baldness. (Fig. 7).

Operative Procedure

The Doppler probe was used to trace the course of the frontal and parietal branches of superficial temporal artery preoperatively. A triangular flap adjoining the defect is designed such that it intersects perpendicularly to the direction of hair flow and includes both or one of the branches (Fig. 8) of the superficial temporal artery. The design of the flap allows a rotation transfer of a fan shaped flap centering on the upper part of the anterior auricle. The distal border of the flap is incised to the periosteum, then subgaleal undermining of the flap is carried out toward the proximal side of the pedicle. Then a

skin incision, which stops at the subcutaneous fat layer, is made in the proximal side of the flap. Undermining in the subcutaneous fat tissue is advanced proximally taking care not to injure the hair follicles. By these dissections, the nutrient vessel of the flap is preserved and included in the pedicle because the superficial temporal artery runs in the superficial temporal fascia, which consists of temporo-parietal fascia and galea aponeurosis (Fig. 9). Pedicle dissection toward the proximal side is then made under direct vision at the anterior and posterior sides of the superficial temporal fascia taking care not to injure the superficial temporal artery (Fig. 10) until the flap can reach the defect without tension. The flap is then elevated and transferred to the defect. Suction drain is placed under the flap and the skin is closed by suture in two layers. The donor site is closed in V-Y advancement fashion employing subgaleal undermining (Fig. 11). The suction drain is removed after 3 days.

Fig. 5 Nevus sebaceous scalp

Fig. 7 Inconspicuous scar after 6 months

Fig. 6 Size of the defect

Discussion

The defects of scalp following the excision of benign or malignant tumors, burns or secondary to trauma should be ideally replaced with hair bearing scalp. It not only gives aesthetic results but also reconstructs the defect with a tissue of the same histology. Local flaps can be transposed or rotated invariably lead to dog ear formation. If the defect is large the rotated flaps are inadequate. In the cases where donor site is not closed primarily the secondary defect is grafted with skin, resulting in bald patches. Unilateral rotation scalp flaps based on temporal vessels may also be a good choice, but they move the hairline downwards. Skin traction is a good choice for small defects, but if the defect is large and sutures are placed in tension there is chances of dehiscence postoperatively. Free flaps, such as the rectus abdominis and latissimus dorsi, provide excellent reconstruction in size, tissue bulk, and coverage, but they are

much more complex procedures and their colour and texture is inferior to those of local flaps [4–6]. Bulky free flaps may also make the detection of recurrence more difficult. Fasciocutaneous flaps such as the radial forearm flap are also an excellent choice but, apart from being more complex procedures, are also accompanied by more donor-site complications [7]. Tissue expansion is an appropriate technique with many indications in reconstructions in the head and neck. One of its main advantages is that it provides an excellent tissue match for defects in visible areas. Aesthetic subunits are either preserved or replaced by similar local tissue. There are also several disadvantages: some of the complications are exposure and failure of implants, pain, haematoma, seroma, infection, bone resorption, “dog ears”, and wide scars leading to premature loss of expander. They also require multiple operations, weeks of expansion, and are rather costly [8]. It would also lead to change in the direction of the hair growth. Recent anatomical studies have clarified the structure and vasculature of the temporal region [9]. The superficial temporal artery runs anteriorly to the auricle, appears in the superficial layer above the posterior end of the zygomatic arch, runs in the superficial temporal fascia, and divides into the frontal and parietal branches. It runs in a shallower layer in more peripheral regions and is located mostly in the subcutaneous fat layer in the midline region. The scalp is rich in vascular communications [10]. Superficial temporal fascia, on the other hand, originates in the galea aponeurosis, runs toward the auricle, and joins the frontal muscle anteriorly, occipital muscle posteriorly, and superficial musculoaponeurotic system of the face inferiorly. It adheres tightly to the scalp by sandwiching adipose tissue immediately below hair follicles. The flap using superficial temporal fascia including superficial temporal artery as the nutrient vessel can be elevated relatively easily and safely by undermining the deep layer of the flap under the galea

Fig. 8 Course of frontal and parietal branches superficial temporal artery after Doppler study, course of parietal branch till the flap

Fig. 9 Dissection of the pedicled flap

Fig. 10 Superficial temporal fascia pedicled flap

aponeurotica and the superficial layer of the flap in the subcutaneous fat tissue. This flap, generally called the temporoparietal flap, is useful for various reconstruction procedures including the treatment of microtia as a pedicle

flap and other applications as a free flap [11]. Various reconstruction procedures using scalp flaps with superficial temporal artery as the nutrient vessel have also been reported as a vascular island flap including eyebrow reconstruction and as a pedicle flap [12]. Temporal island flap has been used for reconstruction of facial burn scars [13], and forehead including the hairline [14]. The V-Y advancement flap is a useful reconstructive procedure and has been applied for reconstructing small scalp defects [15]. Bilateral fasciocutaneous temporal V-Y advancement island flaps based on superficial temporal artery has also been used for reconstruction of damaged forehead [16]. Reconstruction of sideburns using an arterial VY hair-bearing scalp flap has also been reported in the literature [17]. However, in all these reports, vascular island flaps with superficial temporal artery as the nutrient vessel were used. Our method used a flap in which superficial temporal fascia is coupled with a skin paddle, and it is a pedicle flap elevated with superficial temporal fascia as the pedicle rather than a vascular island flap having superficial temporal artery as the pedicle. There are reports on reconstruction using a scalp flap with a pedicle consisting of the superficial temporal artery and part of the superficial temporal fascia [18]. They considered that superficial temporal vein must be included in the pedicle when a flap larger than $50 \times 70 \text{ mm}^2$ was prepared in consideration of the venous drainage and that inclusion of superficial temporal fascia would allow elevation of a flap for a defect as large as $80 \times 60 \text{ mm}^2$. The flap reported in this paper included a large part of superficial temporal fascia in the pedicle, and it remained continuous with the lower layers at the proximal site of the pedicle, so that it received a stable blood supply not only from superficial temporal artery but also middle temporal artery and deep temporal artery. With this flap, no problem with the venous drainage was observed. This method can be performed by a simple procedure, provides a stable blood supply, and allows designing of the flap in consideration of the direction of the hair flow. In case-I, the long lines of the scalp island triangular flap were

Fig. 11 V-Y Closure of the dissected flap

parallel to the hair direction. The result was marked and it gave a bush like appearance. On the other hand, in case-II, the long lines were almost perpendicular to the hair direction and the result was good. The choice of raising the flap on either frontal/Parietal or both depends upon the location and size of the defect. The only technical innovation was the use of this pedicled flap in a perpendicular direction also as in all the cases reported in the literature the flap was advanced in a parallel direction to the hair flow. In addition, the use of V-Y advancement fashion allows donor site closure primarily. Since, this method makes onstage reconstruction of relatively large defects possible, it is considered to be very useful for the repair of scalp defects.

Conflict of interest None.

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