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CASE REPORT

The venous flap — a safe alternative to the simple vein graft in a special situation

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Summary The use of free tissue transfer has evolved to become the mainstay of treatment of tissue defects. The reconstructive surgeon can choose from a wide variety of flaps. Flaps are chosen based on the tissue defect and also on the characteristics of the pedicle in terms of calibre and vessel length. Occasionally situations arise necessitating the use of vein grafts. Vein grafts can be used primarily as part of a planned procedure to increase pedicle length or as a salvage technique following anastomotic complication. We report the use of venous flap instead of a conventional vein graft, for restoring continuity of the arterial flow in the pedicle of a free flap, following resection of a thrombosed segment. A venous flap harvested from the left leg with a cutaneous vein was used in a flow-through fashion to restore the continuity of the arterial inflow to the flap.

The venous flap is an ideal option in selected cases instead of a vein graft. This is specifically indicated where there is a shortage of soft tissue to cover the anastomosis. The pedicle can then be covered in a tension-free manner. Thus in addition to extremity wounds, the venous flap can be used safely in salvage of difficult situations in the head and neck area.

The use of free tissue transfer has evolved to become the mainstay of treatment for tissue defects. The reconstructive surgeon can choose from a wide variety of flaps. These flaps are chosen based on the tissue defect and also on the characteristics of the pedicle in terms of vessel calibre and length. In head and neck reconstruction, most flaps chosen have a sufficient pedicle length and hence do not require vein grafts. Yet there are occasions when the length of the pedicle is insufficient and a vein graft is required. In head and neck surgery these situations can arise either due to inherent deficiency of the pedicle length or more commonly due to lack of suitable recipient vessels in the ipsilateral

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Figure 1 The wound prior to exploration with the haematoma in the cheek.

neck, thus necessitating a crossover to the opposite side. It is an accepted technique to use interposition vein grafts in these instances. Moreover, wound infection remains a major complication of head and neck reconstruction. Infection around the vascular pedicle can result in acute rupture of the anastomosis with consequent bleeding. Often following radiotherapy or previous surgery the vessels are friable. Such situations render flap salvage easier said than done. We describe the use of a venous flap as an alternative conduit to a simple vein graft. It has the additional advantage of providing skin cover for a tension-free closure over the anastomosis.

Figure 2 The venous flap.

Case report

A 45-year-old male presented with a deformity of the left side of his face following a traffic accident. The injury had caused mutilating fractures of the maxilla and the orbit. After an evaluation of the deformity, it was decided to restore the lost volume of the mid-face with a vascularised iliac crest bone graft. The vascularised iliac bone flap was harvested based on the deep circumflex iliac artery. The vascular pedicle was anastomosed to the facial artery and vein just above the mandible (Fig. 1). The flap remained well perfused until the ninth day, when rapidly increasing swelling over the area of anastomosis was noted. Re-exploration of the anastomosis revealed uncontrolled bleeding from a transected minor branch on the arterial pedicle, situated in close proximity to the anastomosis. In order to obtain haemostatic control and avoid narrowing the anastomoses, the entire arterial anastomoses with the branch had to be resected. An interposition vein graft was thought necessary to restore a tension-free continuity of the anastomosis. As a result of the oedema, the approximation of the wound edges was not now possible. This meant that any vein graft and anastomoses would now be exposed. To address the issue of needing a vein graft and at the same time provide tension-free coverage of the pedicle, a venous flap was considered (Fig. 2). A venous flap with a cutaneous vein matching the calibre of the transected artery was harvested from the left leg and interposed to restore the arterial continuity. In addition a tension-free coverage of the pedicle was achieved. The flap was salvaged successfully through this timely intervention. The venous flap survived well in spite

Figure 3 The vascularised venous flap and skin graft over the residual raw area.

Figure 4 Revision surgery months later with excision of the flap skin and primary closure.

of congestion and bruising initially, however, there was no blister formation (Figs. 3 and 4).

Discussion

Over the last two decades, reconstructive surgery of the head and neck has had a paradigm shift from using pedicled flaps to free tissue transfer. An array of flaps has gained popularity over the years. Most centres have achieved success rates from 93 to 98%.[1,2] To obtain these high standards, it is clear that identification of complications and then prompt intervention is crucial. Venous thrombosis has been shown to be the commonest cause of failure of free flaps.[3] At exploratory surgery the issue of thrombosis can be addressed in various ways. In the setting of complete thrombosis, thrombectomy using Fogarty #2 and #3 catheters can be effective in restoring vascular patency.[4] It has been our practice to resect the segment of the vessels bearing the thrombus, particularly if significant time has elapsed. We feel it is hardly ever possible to clear away all the clot without injuring the intimal surface in these situations. It is crucial that the re-anastomosis is tension free. Seldom is this achievable when a segment of the vessel has been resected. Hence vein grafts become necessary. Interposition vein grafts have often been thought to be associated with a high complication and flap failure rates. Germann and Steinau reported a flap survival rate of 96.2% in the group with the use of vein grafts compared to 96.7% for those without vein grafts.[5] They concluded that the use of vein grafts is not associated with a higher flap failure rate, when technical pitfalls can be avoided, and vigilant monitoring is possible. In head and neck reconstruction primary interposition grafts have been fraught with complications. However they can be the only viable option to salvage some anastomotic complications in a tension-free manner.

The use of venous flap, with the vein as an arterial conduit, has been described in the salvage of hand trauma. The venous flap has been used both as a pedicled flap and as a free flap.[6] Significant experimental studies on circulation and survival of venous flaps have been done by Thatte and Thatte[7] and Tang et al.[8] These have been followed up with clinical studies, and based on their use the venous flap has also been classified by Chen et al.[9]:

(I) Free venous flaps of total venous perfusion, with both ends of its vein being anastomosed to two veins.
(II) Pedicled venous flaps of total venous perfusion, with one end of the vein intact and the other end of the vein anastomosed to an adjacent vein.
(III) Free venous flaps of arterialised venous perfusion with an afferent A—V fistula. The distal anastomosis was an artery to a vein, but the proximal anastomosis was a vein to a vein.
(IV) Free venous flaps of total arterialised venous perfusion. In this flap both ends of the vein were joined to arteries with a pressure gradient between these two points.

Similar classifications on venous flaps have been proposed by Fukui et al.[10] The common denominator in these studies is that all flaps have been on the upper extremity. This is worthy of mention as the flow dynamics in these flaps have been proposed to depend on the pressure gradient that exits between the ends that are anastomosed. The Type B-1 or veno-venous flow-through flap done in the experimental and clinical case series showed variable degrees of necrosis of the skin paddle.[10] These are similar to the findings of the Type I venous flap of the Chen et al. classification.[9] Such venous flaps showed variable colour change in the initial course and subsequently regained normal skin colour after about 3 weeks. In the present case the venous flap harvested was of Type IV according to the classification of Chen et al.[9]

Zhu et al.[11] used saphenous free flaps for lower limb defects, but the prohibitively high failure rate in their series drew them to conclude that these could be used only in an un-infected environment and with the size of the skin paddle restricted to around 3 cm in width. The use of a flow-through flap as a conduit for the artery has been more successful (Type IV). The lower incidence of failure is partly due to the better circulation in this type of flap.[9]

In conclusion, venous flaps instead of a vein graft have been described, yet are used predominantly in extremity surgery. This report applies the same principle to salvage a free flap in the head and neck using it to restore the arterial continuity and at the same time provide tension-free cover to the anastomotic area. The use of venous flap in a situation as in the case described in this report has not been mentioned in the literature before. The fact that this procedure resulted in the salvage of the vascularised iliac flap reminds us to keep this rare option in mind in case of a similar situation.

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