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Original article

Feasibility of type III venous flap in coverage of hand defects following trauma and burns

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ABSTRACT

Introduction: venous flaps are alternative reconstructive option for coverage of defects. They are nourished by venous blood flow or by arterial blood flowing through the venous network. This study was conducted to assess the feasibility of venous flap in coverage of extremities defects following trauma and burns.

Material and methods: Over a period of one year, 15 arterialized venous flaps were applied to skin defects of the hand. Postoperatively flap were monitored for survival and patients followed up for three months.

Results: In patients with flap area ranging from 6 to 10 cm^2, all the 6 patients have complete survival (100%). In 11–15 cm^2 group 3 out of 5 patients have complete survival (60%) and 2 have partial survival (40%). In 16–20 cm^2 group 1 out of 3 have complete survival (33.3%) and 2 have partial survival (66.6%). In 21–25 cm^2 group there was only 1 patient who had complete necrosis. This study suggests that small venous flaps have better survival rate as compared to large flaps. Variable degree of congestion was present in all the patients in first post operative week which gradually disappeared in second week.

Conclusion: The venous flap is good alternate for reconstruction of the small defects of hand and digits. It is easy to designed and harvest. It is thin and pliable, without need to sacrifice a major artery at the donor site and with no limitation on the donor site.

1. Introduction

A flap is a composite block of skin and other tissues that maintains its own blood supply while being transferred from a donor to a recipient site. Flaps range from simple advancements of skin and subcutaneous tissue to composite free flaps that may contain any combination of skin, muscle, bone, fat, or fascia. The standard free flap requires both artery and vein to be anastomosed to those of the recipient area. However donor sites for these flaps are limited and cause morbidity. Since 1981 there have been both clinical and experimental reports of successful new flap transfer that were nourished by venous blood flow or by arterial blood flowing through the venous network.[1] Nakayama, The first one is called venous flap and second one is arterialized venous flap.[2,3] The arterialized venous flap technique involves the use of two veins in the skin flap, one for arterial flow and one for venous drainage. Historically, an early technique for the rescue of an ischaemic extremity consisted of the creation of an arteriovenous fistula between the venous and arterial systems of the extremity, following which the venous system served as a route of arterial inflow. The main advantage of an arterialized venous flap is the ease of harvesting a thin flap without the need to sacrifice a major artery at the donor site. The design of venous flaps is very easy because of direct visualization of the venous plexus through the thin overlying skin. There is no limitation of the donor site because it is possible to find the venous network at any place of the body. Despite many advantages, arterialized venous flaps are not commonly selected as the first choice for microsurgical reconstruction. An unstable postoperative course and difficult monitoring of the flap make it a less likely choice as compared with other conventional flaps. As a result, the clinical application is very limited. Aim of this study was to assess the feasibility of venous flap in coverage of extremities defects following trauma and burns.

2. Material and methods

It a prospective study conducted in plastic surgery unit, department of surgery NSCB medical college Jabalpur. All the patients with post burn and post traumatic small to medium sized defect of hand were included. Patient's written and informed

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consent was taken. Institutional ethical committee clearance was taken before starting the study. All cases had either exposed bone, joints or tendons which required flap coverage. Most of the patients fall in 20–40 years age group. All the patients were male. In 9 out of 15 patients, cause of hand defect was electric injury (60%) and 6 patients were post traumatic/crush injury (40%). In 8 out of 15 patients there was left hand defect (53.3%) and 7 patients had right hand defects (46.7%). Dorsal aspect of hand was involved in 8 patients (53.3%) and palmar aspect in 7 patients (46.7%). Proximal half of hand was involved in 7 patients (46.7%) and distal half in 8 patients (53.3%). In 14 patients right hand was dominant hand and in 1 patient left hand was dominant. Nerve, vessel and tendon status were normal in all patients.

Over a period of one year, 15 arterialized venous flaps were applied to skin defects of the hand. The donor site was flexor or extensor aspect of ipsilateral forearm. Recipient site was prepared first by excision of devitalized tissue in the floor and edges of wound. The size of the defect and length of the vein required were measured. The prospective flap was marked in the fore arm. The venous network in the fore arm is marked and flap is plotted in such a way to keep the one main vein in the centre of the flap. The size of the flap was determined and marked so that flap consisted of a skin, subcutaneous fat, and a vein with one proximal and two distal ends. Under tourniquet the flap is raised keeping the venous network intact. For safety the fascia is also included in the flap. Flap is cut all around to make it an island and proximal and distal veins were dissected in order to gain sufficient length. The vein was irrigated with heparinized saline solution and prepared for anastomosis. The adjacent artery was exposed and arteriotomy was performed at the recipient artery. The proximal end of the vein was sutured to it end-to-side, using 8/0 nylon sutures thus making it an A-V type flap. Radial artery was recipient artery in 13 cases while ulnar artery was recipient artery in 2 cases. All anastomosis of vein and artery was done end to side. The size of anastomosis was 3–4 mm in all cases. In all cases single vein was anastomosed with artery in retrograde manner.

The patency of the anastomosis was assessed immediately by sensation of the thrill on the venous side and the bleeding edges of the skin flap. The flap was sutured to the edges of defect loosely and the donor site was usually closed primarily or by split-thickness skin graft. A light dressing was applied to allow close observation of the flap for colour and venous congestion. Postoperatively heparin 5000 IU was given intravenously for 3 days. Postoperatively flap will be monitored for survival by observing colour and warmth. Any necrosis will be noted and photographs will be taken. Patients will be followed up every week for 4 weeks than every month for three months. Physiotherapy will be advised as per requirement of the patient.

3. Results

We performed type III venous flap in 15 patients over a period of one year. In all patients donor site for flap was forearm. In our study 73.3% patients had flap area of 6–15 cm^2, 20% patients had flap area between 16 and 20 cm^2 and only 1 patient (6.7%) had flap area more than 20 cm^2. Outcome was assessed at the end of 2 weeks. Flap which had marginal necrosis was considered as partial survival. Variable degree of congestion was present in all the patients in first post operative week which gradually disappeared in second week. Complete survival was observed in 10 patients (66.6%) partial survival in 4 (26.7%) and complete necrosis in 1 (6.7%) patient. In our study in patients with electric injury 77.8% had complete survival, 1 had partial survival and 1 had complete necrosis; whereas in post traumatic group 50% patients had complete survival and 50% had partial survival. In patients having defect on dorsal aspect 6 out of 8 have complete survival (75%), 1 have partial survival and 1 have complete necrosis; whereas in palmar aspect defect 4 out of 7 have complete survival (57.14%) and 3 have partial survival (42.85%). In patients with flap area ranging from 6 to 10 cm^2, all the 6 patients have complete survival (100%). In 11–15 cm^2 group 3 out of 5 patients have complete survival (60%) and 2 have partial survival (40%). In 16–20 cm^2 group 1 out of 3 have complete survival (33.3%) and 2 have partial survival (66.6%).all patients with partial survival of flap healed spontaneously with conservative treatment and did not required secondary surgery. In 21–25 cm^2 group there was only 1 patient who had complete necrosis (Table 1) (Photographs 1–9).

Table 1
Outcome depending upon flap area.

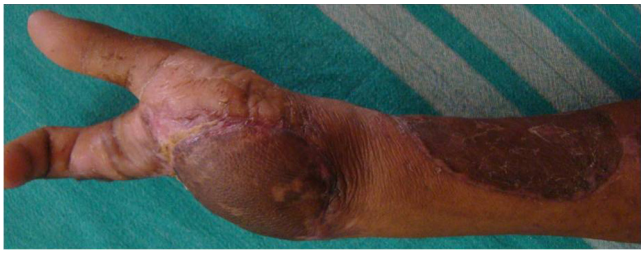
Flap area (cm^2)	No. of cases	Complete survival	Partial survival	Complete necrosis
6–10	6	6	0	0
11–15	5	3	2	0
16–20	3	1	2	0
21–25	1	0	0	1
Total	15	10 (66.66%)	4 (26.66%)	1 (6.66%)

Photograph 1. Post traumatic raw area right hand.

4. Discussion

The first experimental study performed on the arterialized venous flap was described by Nakayama et al.[1] Since then many experimental studies have been performed to evaluate venous

Photograph 2. Flap elevated and sutured.



Photograph 3. Post operative results after 3 months.