

## Flap from Flap: A Simple Answer to Difficult Situations: A Case Series

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### Introduction

A skin flap (pedicle graft) is a partially detached segment of skin and subcutaneous tissue that includes a blood supply essential to its survival [1].

A flap is a piece of tissue with a blood supply that can be used to cover an open wound. A local flap implies that the tissue is adjacent to the open wound in need of coverage. Local flap coverage of a wound is the next higher rung up the reconstructive ladder after a skin graft. Examples of wounds that require flap coverage include wounds with exposed bone, tendon, or other vital structure and large wounds over a flexion crease, for which a split thickness skin graft or secondary closure would result in tight scarring. Paucity of local flap options is frequently encountered problem in cases of severe burn and trauma. Sometimes the only available flap is not able to provide complete coverage of defect. In such situations a random flap can be taken from previously performed flap.

A Random pattern flap is defined as a flap which lacks any significant bias in its vascular pattern [2]. Random pattern flap is the one where circulation to a random flap is provided in a diffuse fashion through tiny vascular connections from the pedicle into the flap. The pedicle must be bulky to increase the number of vascular connections. The more vascular connections, the better would be the circulation to the flap, the better its survival.

In general, a random flap does not have as reliable a blood supply as an axial flap. Nonetheless, the relative ease of creating random flaps makes them useful almost anywhere on the body.

The blood supply in a random pattern flap comes diffusely from the remaining skin attachment, which serves as the pedicle. For optimal circulation and flap survival, the flap should be designed so that the length is no more than three times the width.

When creating a random local skin flap, you take advantage of the relatively loose, excess skin in the vicinity of the skin defect. Random flaps require less technical expertise than axial flaps. Random skin flaps have several application which varies from coverage of wound from face, particularly around the eyes, nose, and mouth to the lower extremity like the one described by Haroon-Ur-Rashid et al. who found that distally based random skin flaps were effective in covering trauma-associated soft tissue defects over the upper two thirds of the tibia [3]. These random flaps can also be used as direct flaps for the reconstruction of hand as well as for fingertip reconstruction [4].

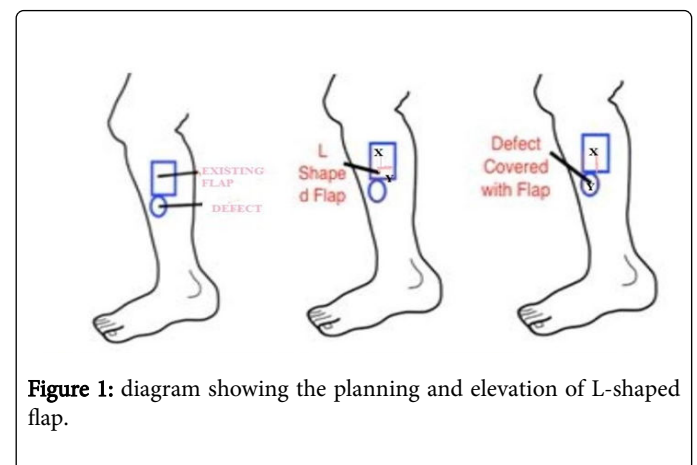
### Methodology

A case series was conducted after institutional review board

approval where a total of 4 patients having some form of defects in the areas adjacent to the preformed flaps were selected and underwent the surgery. Informed written consent was taken from each patient and their attendants. It was an observational study and was carried over a period of 18 months and the patients selected were informed prior about the procedure to be done.

### Planning

Simple transposition of part of flap may not cover residual defect. In such condition a L shape flap can be planned keeping ratio of 1:2 or 1:3. If the dimensions of Vertical limb and Horizontal limb of L is X and is Y respectively then total flap length would be X+Y. The Horizontal limb (Distal) Y is usually the part of flap which covers the defect (Figure 1).



**Figure 1:** diagram showing the planning and elevation of L-shaped flap.

### Case Reports

#### Case-1

The first case was of a 28 years old male who had a defect in lower third of left leg following road traffic accident about 5-6 months ago. Patient at that time had a compound fracture tibia with vascular injury which was stabilized with external fixation and the defect was covered previously with cross leg flap. After about 1 month the flap was divided and later on fixators were removed. Now the patient was presented with exposed tibia in lower part of flap. Since it was a single vessel limb and scarring in the surrounding region, there were no local flap options available. An L shaped Flap from pre-existing flap was planned and elevated to cover the wound (Figure 2a and 2b).



**Figure 2a:** L-shaped flap coverage of lower third leg defect.



**Figure 2b:** L-shaped flap coverage of lower third leg defect.



**Figure 3a:** L- shaped flap coverage of lower third leg defect.



**Figure 3b:** L- shaped flap coverage of lower third leg defect.

In post-operative period, there were no complaints of flap necrosis, congestion or infection. Patient was discharged after 6th day.

## Case-2

Second case was of a known chronic smoker with childhood burn in right lower leg that was presented with a defect of lower third of right leg. He had history of undergoing local flap coverage for post traumatic leg defect 2-3 years back. There was no other available options left for another local flap from nearby site due to extensive scarring, and moreover patient being a chronic smoker was not having a good vascular supply to the lower limbs. Yet again a L shaped flap was planned from the pre-existing flap and defect was coverage with horizontal limb of flap (Figure 3a and 3b).

## Case-3

Third case was of a young boy of age 16 years with post burn scarring all over his face. It was a challenging case as the boy had previously undergone Nasal reconstruction using forehead flap and there was scarring all over his face to plan for the eyelid reconstruction was a difficult task by any local flap from the scarred region. But the Eyelid reconstruction was planned using L shaped flap from previously done forehead flap (Figure 4a and 4b).





**Figure 4a:** Case 3 with Facial Burns.



**Figure 5a:** Previously Done Inferiorly Fasciocutaneous Flap Cover of the Right Thigh from Opposite Leg.



**Figure 4b:** L- shaped flap for left eye lid reconstruction.



**Figure 5b:** L-Shaped Flap Planned of Lower Thigh Defect.

#### Case-4

Fourth case was of a 30 years old female who had a malignant lesion in right thigh for which local excision and coverage from inferiorly based fasciocutaneous from left leg were done as patient was not giving the consent for any other regional or free micro vascular flap. Following which patient had developed a small defect in lower thigh region near the previously done flap. Again a L shaped flap coverage was planned and executed Figure 5a and 5b for the defect in the vicinity of the previously done flap. Figure 5c showing post-op picture of the same patient after 3 months.



**Figure 5c:** Post-Op Picture after 3 Months.

All patients were did well in the post-operative period and showed no evidence of flap necrosis or any other flap related complication. All four patients were discharged between 5-7 post-operative days

## Discussion

The earliest flaps were random flaps, such as the random pedicled flap (from the upper arm to the nose) described by Tagliacozzi in the 1500s. Other important contributors to the history of skin flaps include von Graefe in 1818, Mutter in 1843, Dieffenbach in 1845, and Gersuny in 1887. Gilles and Fillatov described the tubed pedicle flap in the early 1900s. These flaps were limited by their length-to-width ratios of 5:1 for the face ranging to 1:1 for the lower extremity. As described by Blair in 1921, only by delaying a flap could a surgeon exceed that length-to-width ratio [5].

Manchot defined the vascular patterns of skin circulation in 1889, and Davis demonstrated axial and pedicle flaps in 1919 [6]. In 1965, Bakamjian described the deltopectoral flap and reintroduced arterial flaps based on the initial efforts of Esser [7]. In 1970, Milton demonstrated that flap survival was based not on the length-to-width ratio but rather on the blood supply that was incorporated into the flap [8].

The cutaneous vascular supply is composed of 3 main levels of vessels supplying the fascia, subcutaneous tissue, and skin. The subcutaneous vessels exit at the superficial fascia and divide the subcutaneous fat into a superficial and deep layer. It is formed by both musculocutaneous and septocutaneous arteries. The cutaneous or subdermal vessels are the main blood supply to the skin. Located at the junction between the deep reticular dermis and subcutaneous fat, they are responsible for the dermal bleeding from the edge of the skin flap. The dermal or subepidermal vessels are located at the papillary ridge to the dermal-epidermal junction. They undergo changes in size from arteries to arterioles to capillaries [9].

By definition, random skin flaps lack a specific named vessel. It is perfused from musculocutaneous or septocutaneous perforators located near the anatomic base of the flap.

As the vascularity of the skin is refined, the concept of a random web of perfusion in the subdermal plexus is giving way to the concept of angiosomes, or units of perfusion, defined by particular perforating vessels [10]. This concept can only improve the design and success of local flaps. Venous drainage from flaps occurs by way of the subcutaneous veins and/or venae comitantes of the supplying artery. Microcirculation within flaps allows communication between the arterial and venous systems. Lymphatics also are involved in the microcirculation, and their disruption may contribute to flap edema [5].

So far we have seen that the random pattern flaps are providing us the option of effective coverage of the wounds without causing much of the donor site morbidity and without taking into consideration of dissecting out the named reliable vascular pedicle.

Once the random flap of adequate dimension has been elevated and placed to cover the defect, the monitoring of the viability of flap is an important aspect as early recognition of ischemia is important in preventing subsequent flap necrosis, thus flap failure. Clinical observation is the best method to assess a flap. An extremely pale flap may signify arterial insufficiency, while a blue flap may be secondary to a failure of venous outflow. Two additional tests often used to assess viability are capillary refill and warmth. Assessment of bleeding from the flap after stabbing it with a small needle is believed to be one of the most reliable methods of clinical assessment [11].

In addition to clinical assessment, objective tests such as pH monitoring and transcutaneous oxygen tension ( $PO_2$ ) can aid in early detection of flap ischemia [12-14]. Doppler ultrasound is used commonly and laser Doppler is increasingly useful [15,16]. Surface temperature monitoring is another dependable technique [17]. Fluorescein dye and illumination with a Wood lamp is useful; however, it is cumbersome, and adverse reactions to the dye have been reported [18,19].

In the past for the defects which were in the close vicinity of already previously done flaps, there weren't many options left. By elevating a L shaped flaps which is a random pattern flap from the previous flap could provide a solution. There is no mention of such flap in the literature, in that way it has been a unique approach in this direction.

In our conducted case series, 4 such flaps had been done in our institution. In which 2 were for leg defects, one for thigh region and one for eyelid reconstruction. All 4 flaps were survived very well.

L-Shaped Flap is a random pattern flap which is lacking any fascia and these flaps can be raised in the ratio up to 1:3. In our experiences, flaps have been survived very well. One of the reasons for such flaps to

survive may be the low metabolic demand of flap. We had not faced any problem with such flaps in post-op periods. However, if such flaps were elevated from the pre-existing flaps near the zone of trauma, there could be chances of flap necrosis later on with inadequate length to breadth ratio. The options available other than the described local flaps aren't many. Options may include application of negative pressure wound therapy followed by skin graft but in case of exposed bone the only available option that may remain would be some regional flaps or a microvascular free flap.

Out of these four cases, the case of 16 years old boy was a challenging task. There were no options for raising the local flap to reconstruct the eyelid as there was only scarred tissue all around his upper face and forehead region. But using L-Shaped flap, made the difficult task to complete effectively.

In this way one can provide the solution to the small defects in the vicinity of the previously done flaps where no other options for local or to say the least regional flaps are available and for the coverage of large defect more traditional flaps would be required.

Although this very concept of such a flap is in its naïve stage but it could have been proved a boon in reconstructive surgery field.

## Conclusion

Random pattern flap can be raised from pre-existing flap adjacent to wound can be a simple, reliable and easy to perform flap even in difficult conditions.

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