

## Review Article

# Flaps in reconstructive surgery

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**Received:** 13 July 2022

**Accepted:** 28 July 2022

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### ABSTRACT

A flap is one with a persistent blood supply that does not rely on the recipient's bed to perfuse donor tissue. Free flaps are used in a different context. Before reconstructing any wound bed, the surgeon must ensure that the receiving bed is properly prepared. The wound must be free of any necrotic or ischemic tissue. In addition, signs of infection such as local cellulitis, significant edema, or purulent drainage should have decreased. Flaps have wide applicability and choice, with an almost infinite range of flaps available to cover even the most complex defects. It is necessary to consider the aesthetic and functional results, as well as the comorbidities and possible morbidity of the donor site. The routine use of flaps has drastically expanded the surgeon's ability to care for the injured patient. In addition, previously unresectable cancers have become resectable with the ability to offer flap reconstruction. The ability to move tissues has improved the quality of life of countless patients.

**Keywords:** Flap, Surgery, Angiosome

### INTRODUCTION

A flap is one with a persistent blood supply that does not rely on the recipient's bed to perfuse donor tissue.<sup>1-4</sup> They are versatile and can be used to cover large defects, replace structures or provide adequate coverage over joints. There is also the possibility of transferring them as complete muscle units, which is beneficial in the context of the return of function once it is connected to the receiving nerves.<sup>1-3</sup>

The volume of tissue transferred can contain multiple types of tissue, including skin, muscle, nerve, fascia, and bone. The increased volume of tissue transferred requires constant perfusion and will be compromised if arterial supply or venous drainage is disrupted during or after tissue transfer.<sup>1-3</sup>

This review of the topic will discuss the general approach to the use of flaps in reconstructive surgery, as well as basic nomenclature and general considerations in the perioperative period, including complications.

### THEORETICAL FRAMEWORK

A flap is a transfer of tissue with its intrinsic blood supply from one part of the body to another. The blood supply to a constant flap is independent of the receiving bed. They are classified according to the type of blood supply, the proximity of the donor tissue to the recipient, and the composition of the tissue, as well as how the donor tissue is transferred to the recipient's tissue defect.<sup>1-3,5-8</sup>

Random skin flaps contain only skin and/or subcutaneous tissue and the blood supply to a random flap is provided by the many unnamed vessels of the subdermal plexus. Axial flaps take advantage of regional areas perfused by angiosomes; a concept that has revolutionized flap design.<sup>8</sup>

With a dedicated flap, the vascular supply remains anatomically connected during flap transfer. For free flaps, the artery and at least one vein disconnect during transfer and are micro-surgically reconnected to a new artery and vein at or near the recipient site. Creating a

free flap is complex and requires a high learning curve, planning, and surgical experience.<sup>7,8</sup>

Free flaps are used in different contexts: When less complex reconstructive methods have failed, when deep structures are exposed, when there is an absolute need to combine reconstruction with cosmetic appearances, such as with facial structures or the female breast, when the morbidity of the donor site will be reduced through the use of microsurgical transfer, with increasing experience, it is often found that a free flap offers the least donor morbidity and the best functional and/or aesthetic outcome.

Piercing flaps are a special type of free tissue flap that contains a trans-muscular and/or trans-fascial vascular "strap" that leads to the overlying fascia and/or skin only. The vessels are dissected outside the muscle through which they pierce, and the muscle is left behind, relatively intact.<sup>5,6,9-16</sup>

Local flaps use tissue proximal and adjacent to the defect that requires coverage. One limitation to the use of local flaps is the availability of healthy donor tissue. The donor site for a local flap should ideally have sufficient laxity to allow primary closure of the defect, in addition to providing tissue to the recipient site for coverage of the defect. Skin color, texture, and thickness will get very close to the receptor site the closer the flap site is to the defect.<sup>8,17</sup>

Regional flaps are pediculated flaps that use tissue in the vicinity of the defect without actually matching the defect. These flaps are transferred by a release incision along the course of the flap transfer or transferred under a tunnel of skin or tissue along the course. Any rotation of the base of the pedicle or compression of the overlying bridge of the tissue can lead to vascular involvement and more distal tissue ischemia in the flap. Regional flaps use similar skin in quality and color to the recipient site, so they are favored on the face, head, and neck compared to distant flaps or even skin grafts. On the face, the use of "similar tissue" is very important for the long-term aesthetic result. Regional flaps are sometimes used on the trunk or limbs.<sup>8,17</sup>

Distant flaps use tissue away from the defect and can be transferred over long distances as pediculated flaps or free flaps.<sup>8</sup>

The blood supply from a muscle flap is transported through the muscle and may include the overlying tissue. The muscle flaps are well vascularized, and if the skin coverage is inadequate, a split-thickness skin graft can be placed to complete the wound closure. Muscle-only flaps are usually used to cover large or trauma-induced ablative defects, or for functional purposes.<sup>5,12,13</sup>

A flap composed of muscle and its overlying skin and subcutaneous tissue is a musculocutaneous flap. The most

common regional flaps are the musculocutaneous flaps. Musculocutaneous flaps are used for large or deep defects, such as deep perineal defects, or to recreate structures, as with breast reconstruction.<sup>16</sup>

A fasciocutaneous flap is composed of skin, subcutaneous tissue, and the underlying fascia. Fasciocutaneous flaps are commonly based on vessels that arise in fascial planes between the muscles and do not inherently include any muscle in the design. These flaps are less bulky than musculocutaneous flaps and are used to cover large surface defects when the skin alone would not provide adequate coverage.<sup>16</sup>

A perforating flap is another type of fasciocutaneous flap consisting of skin and subcutaneous tissue that is vascularized by a perforating artery (for example, musculocutaneous or septocutaneous). The vessels are dissected outside the tissue through which they pierce, and if the piercer is musculocutaneous, the muscle is left behind. In this way, a large skin flap can be obtained from the same region as a conventional musculocutaneous flap without the need to include muscle, which might not be dispensable.<sup>7</sup>

An osteocutaneous flap is a flap containing a bone component. It is used to replace the missing bone in the head and neck or the long bones of the limbs. An example of an osteocutaneous flap is a fibular-free flap.<sup>4</sup>

Before reconstructing any wound bed, the surgeon must ensure that the receiving bed is properly prepared. The wound must be free of any necrotic or ischemic tissue. In addition, signs of infection such as local cellulitis, significant edema, or purulent drainage should have decreased. However, unlike the use of skin grafts, the wound bed does not need to be well vascularized, as the flap has its own blood supply. Granulation tissue, if present, should be gently debrided back to the base of the wound to reduce levels of bacterial contamination. The margins of the skin should be trimmed to expose the healthy, scar-free dermis.<sup>8</sup>

Irrigation of the wound bed before flap placement should be done to reduce bacterial contamination as much as possible. This is often achieved with 3 to 6 liters. Finally, hemostasis after debridement must be meticulous to prevent fluid accumulations from accumulating under the flap tissue.<sup>8</sup>

In general, the container can be identified with a handheld Doppler, and the required skin island is usually centered on the container. Advanced imaging modalities, such as magnetic resonance angiography and computed tomographic angiography, have become more common and delineate the anatomy of flap dissection in advance.<sup>8</sup>

Piercing flaps require careful planning to reduce the risk of flap failure by preoperative mapping and localizing the piercing arteries using a handheld Doppler. In the

operating room, the main driller is usually identified by making a limited exploratory incision, with additional dissection of the driller until the largest and best driller is identified.

The donor site is closed in layers to minimize postoperative wound dehiscence, and without strain on the suture line. Drains are used for larger wounds. Self-adhesive strips are applied to the suture line, followed by dry gauze, which is secured with a wrapping bandage or adhesive dressing.<sup>1-3</sup>

Vascular involvement is the most common cause of flap failure. Poor flap design and failure to follow up on the angiosome concept of tissue blood supply can lead to partial flap loss if the flap includes too much tissue and extends beyond the anatomical boundary of the flap's blood supply.<sup>8</sup>

## DISCUSSION

A flap is the best approach for wound repair when a primary repair is not possible without undue strain or the wound bed is not susceptible to grafting because the defect is not well vascularized, such as in those with exposed bone or tendon. Flaps are also the best approach for covering large defects or when complex tissue is required to regain normal aesthetics.<sup>7-9,17</sup>

Flap selection begins with an analysis of the defect, including the location and condition of the recipient's bed, comorbidities, cosmetic importance, and functional significance. In addition to evaluating the defect to be closed, the surgeon should consider the morbidity of the donor site, including scarring and functional loss if the flap includes a muscle.<sup>10-13</sup>

Flaps have wide applicability and choice, with an almost infinite range of flaps available to cover even the most complex defects. It is necessary to consider the aesthetic and functional results, as well as the comorbidities and possible morbidity of the donor site.<sup>5,14,16</sup>

As a rule, simple local flaps are used if possible. Regional flaps or distant flaps are used if there are no local options available, or if a distant flap will give a better overall functional and cosmetic result.<sup>5</sup>

## CONCLUSION

The routine use of flaps has drastically expanded the surgeon's ability to care for the injured patient. In addition, previously unresectable cancers have become resectable with the ability to offer flap reconstruction. The ability to move tissues has improved the quality of life of countless patients. Quality of life and cosmetic results are constantly improving as flaps with lower morbidity are developed, with technical success rates close to 100 percent. The design of the axial flap requires the identification of the appropriate vessel on which the

tissue transfer will be based. Local skin flaps should adhere to some simple rules regarding size and shape. In general, the length of the flap cannot be longer than the width of the flap base (i.e., a ratio of 1:1) in most cases to ensure adequate vascular supply to the flap.

*Funding: No funding sources*

*Conflict of interest: None declared*

*Ethical approval: Not required*

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**Cite this article as:** Capriellova YJ. Flaps in reconstructive surgery. *Int Surg J* 2022;9:xxx-xx.