Introduction

A skin flap (pedicle graft) is a partially detached segment of skin and subcutaneous tissue used to cover open wounds. The base or “pedicle” of the flap contains the blood supply essential to its survival upon transfer to the recipient site. As a result, pedicle grafts can be used to cover avascular defects, holes overlying a body cavity, and other wounds where free grafts are unlikely to survive.

Flaps incorporating a direct cutaneous artery and vein are called axial pattern flaps. In this paper, flaps discussed will be based on the deep or subdermal plexus blood supply to the skin (subdermal plexus flaps). As a result, the simple flaps discussed are more limited in size, based on this less robust source of circulation, compared to axial pattern flaps. To preserve the subdermal plexus circulation, it is preferable to undermine skin flaps below the panniculus carnosus muscle layer, when present.

Local Flaps

Subdermal plexus flaps created adjacent to a recipient bed are called local flaps. Local flaps can be advanced (advancement flaps) or rotated into position (rotating flaps). Flaps under either general classification have general advantages and disadvantages, depending upon the wound size, location, and anticipated tension to the area after transfer of the skin flap.

Advancement flaps (single pedicle, bipedicle) primarily close wounds by elevating skin sufficiently to stretch into a given defect. Collagen and elastin fibers within the skin flap will have a tendency to retract and possibly distort the closure site. For example, a single pedicle advancement flap used to close a large eyelid defect, may distort the eyelid and limit function to this structure. Advancement flaps are best used in areas where the skin is elastic and any postoperative tension will not create a functional problem upon wound closure.

Rotating flaps include the transposition flap, interpolation flap, and rotational flap. The most useful of these three techniques is the 90° transposition flap. Unlike advancement flaps, this flap technique brings additional skin to the closure site without relying on elastic advancement. The transposition flap can be used effectively in a variety of body regions including many of the smaller, problematic lower extremity defects encountered in small animal practice.

Z-Plasty is a variation of the transposition flap technique.

Surgical Considerations
Flaps should be kept as short as possible: longer flaps are more subject to necrosis of the distant (terminal) end. Flaps should be measured according to the guidelines established in textbook references (measure twice, cut once). Cloth or thin foam rubber can be used to help determine optimal flap size and positioning before marking the flap outline onto the skin with a felt-tipped marking pen. Alcohol resistant pens are preferable, when using isopropyl alcohol for skin preparation. Should the flap prove to be longer than needed, based on regional tension of the skin bordering the wound, a scalpel blade can be used to remove the redundant flap segment.

Although properly prepared skin flaps can survive on areas devoid of circulation, the wound should be free of infection, necrotic tissue, and debris. Contaminated and infected wounds are managed as open wounds until a healthy wound bed is established. In general, many of the more serious wounds are managed until a healthy vascular granulation bed forms, an ideal time to consider wound closure.

Skin Flap or Skin Graft?

Unlike humans, skin flaps are generally preferred for wound closure in small animals. They are technically easier to perform in most cases. Skin grafting usually is better considered for defects of the distal extremities (with a few exceptions)- carpus to digits; tarsus to digits. Skin flaps are thicker, more durable, and maintain complete hair growth. Skin grafts are thinner, less durable, and hair growth is seldom normal. Thinner grafts loose a variable number of compound hair follicles during harvesting; even full-thickness grafts have less hair growth due to loss or damage to follicles during graft preparation (follicles located in the deep dermis and hypodermis during “defatting”).

The cost associated with local flap elevation and transfer is considerably less than skin grafts. Bandaging usually is unnecessary, and at times undesirable for skin flaps. No specialized instruments are required for skin flap elevation and transfer. The “learning curve” for flap development is not particularly steep for veterinary surgeons.

Large wounds usually require the use of axial pattern flaps, skin grafts, or skin stretchers due to the more limited circulation of the subdermal plexus blood supply for the basic flap techniques discussed in this lecture.

Skin Flap Selection

As noted, advancement flaps primarily rely on the ability of skin to stretch forward to close a given defect. The natural tendency for the dermal collagen fibers to retract back to their original position must be taken into account prior to wound closure. In contrast, skin a few to several centimeters from the wound is incorporated into the 90° transposition flap. Its rotation into the defect brings this source of loose skin to the area where it is most needed, usually without creating tension at closure of the defect. This versatile flap is effective for closing wounds in a variety of locations, including the distal areas of the extremities. The 90° transposition flap, aligned parallel to the limb axis and with its base (pedicle) positioned distally, can pivot into a number of smaller problematic wounds. However, because of the limited circumferential skin present on the extremities, flap measurements necessarily are tailored to the available loose skin present.
Modest errors in flap measurement and elevation can result in the inability to close the donor area. The veterinary surgeon must keep in mind that it is not necessary to close all wounds completely: a flap that covers a major portion of a wound may be sufficient. The flap achieves partial closure, while the borders of the transposed flap promote contraction and epithelialization of the remaining exposed wound areas.

Reference: