11

Local Flaps

PLATES

INTRODUCTION

A pedicle graft or skin flap is a partially detached segment of skin and subcutaneous tissue: the base or pedicle of the flap maintains circulation to the skin during its elevation and transfer to a recipient location. Pedicle grafts developed adjacent to the recipient bed are termed local flaps. They represent one of the most practical methods of closing defects that cannot be approximated by simple undermining and suturing. The effective use of these flaps usually depends on forming a flap in a neighboring area in which loose, elastic skin prevails. Any secondary defect created by the transfer of the flap to the defect can be closed directly. Local flaps are both simple and economical to perform. They are more likely to maintain a similar pattern of hair growth and color than distant flaps. Local flaps have been effectively used to close defects in dogs, cats, birds, and other species. The 90-degree transposition flap is particularly useful in this context.

Local flaps are classified according to their method of transfer: flaps that advance in a forward direction are *advancement flaps* and those that rotate or pivot into position are *rotating flaps*. Most local flaps are based over the subdermal plexus circulation unless a direct cutaneous artery and vein are fortuitously included in the base of the flap.

Ideal donor areas have ample skin available to elevate a flap without creating a secondary defect (donor bed) unamenable to simple closure. Donor sites subject to excessive motion and stress should be avoided whenever possible, as they are prone to wound dehiscence or can compromise local mobility. Exceptions include cases in which closure of a wound for the protection of exposed structures has priority over the creation of a secondary defect. The secondary defect, in turn, can be closed by undermining and primary closure, a second flap, a free graft, or healing by second intention.

Local flap procedures begin with assessment of lines of greatest versus least tension. Local flaps are designed to advance or rotate into place. An advancement (sliding) flap is developed parallel to lines of *least* tension, to facilitate its forward stretch over the wound. A 90-degree transposition flap is aligned parallel to the lines of greatest tension, to obtain the bulk of the flap required to cover the defect. When the transposition flap is rotated into place, the donor site can be closed directly because minimal tension lines are perpendicular to the suture line.

Factors that maximize the circulation to the pedicle graft should be considered during flap planning. Large flaps should include a direct cutaneous artery and vein whenever possible. Unfortunately, the consistent development of axial pattern flaps requires predictable anatomical landmarks and proper patient positioning. When possible, it may be beneficial to position the base of local flaps in the direction of known, direct cutaneous vessels arborizing in their general vicinity, thus improving the perfusion pressure to the pedicle graft.

Increasing the width of a pedicle graft does *not* increase its total surviving length. Flaps created under the same conditions of blood supply survive to the same length regardless of flap width. Increasing the width of the pedicle graft only permits the chance of including direct cutaneous vessels in the flap. Moreover, the cutaneous circulation differs regionally, and a set length/width ratio is not applicable. Narrowing of a pedicle can reduce blood perfusion to the body of the flap and increase the likelihood of necrosis. Procedures that narrow the pedicle, such as the back-cut technique (counterincisions) are best avoided. Axial pattern flaps are an exception to this rule, as long as the direct cutaneous artery and vein are preserved. Creating unduly long subdermal plexus flaps also can result in necrosis. As a rule, the author recommends the following:

1. Create flaps with a base slightly wider than its body to avoid inadvertent narrowing of the pedicle.
2. Limit flaps to the size required to cover the recipient bed without undue tension.

Two or more small flaps may be preferable to a single, large pedicle graft whose effective circulation at the end of the flap may be questionable.

> A key point in skin flap survival is to keep the length of a skin flap to a minimum. In other words, *keep the flap as short as possible* to close a given wound without excessive tension.

The surgeon should consider the use of bipedicled flaps when longer flaps are required. A "delay procedure" should be considered when there is a concern regarding the flap's circulation and survival if transferred in a single stage to the recipient site. Careful planning and meticulous, atraumatic surgical technique are necessary to prevent excessive tension, kinking, and circulatory compromise to the flap.

All measurements of the defect and proposed flap are recorded in centimeters. As a precaution, a cloth or foam rubber template of the flap can be made to represent the proposed dimensions of the defect and the additional skin required for the flap to reach the recipient bed from the proposed donor site. The flap template is positioned over the defect, and the base of the flap model is held in a fixed position as the model is transferred to the proposed donor site. This procedure is repeated until the template is an accurate model for successful flap transfer. The flap is drawn on the skin with a marking pen to provide reference lines for the skin incision. Once one becomes familiar with certain flap techniques, the measurements can be drawn directly on the skin without resorting to the templates.

Atraumatic surgical technique is essential to the successful execution of local flaps. Their comparatively limited blood supply from the subdermal plexus requires greater care in their development and transfer. Skin hooks and Adson-Brown forceps are best used to manipulate the skin flaps. In general, flaps should be kept as short as possible in order to assure optimal perfusion to the distant edge.

ADVANCEMENT FLAPS

The single pedicle advancement flap, bipedicle advancement flap, and the V-Y advancement flap are examples of pedicle grafts moved forward into a wound without lateral movement. The single pedicle advancement flap (sliding flap) is probably the most common local flap employed in veterinary medicine because of its simple design and lack of a secondary defect requiring closure (Fig 11-1). Paired single-pedicle advancement flaps can be employed to close square or rectangular defects, resulting in an H closure design (H-plasty). (See Plate 34.) V-Y advancement is a triangular, single pedicle advancement technique primarily employed to relieve tissue tension; it has limited efficacy in wound closure.

The bipedicle advancement flap is constructed by making a skin incision parallel to the long axis of a defect, with a flap width generally equal to the width of the defect. (See Plate 35.) The undermined skin segment is advanced into the recipient bed. The bipedicle advancement flap has the advantage of two sources of circulation to maintain a longer flap body. The relaxing (relief or release) incision used to aid in wound closure is a bipedicle advancement flap by design (Fig 11-2). (See Plate 20.)

It must be noted that advancement flaps, despite their simple design and application, have limitations that preclude their routine use. The advancement flap primarily relies upon wound coverage by *stretching* over the defect. As a result, an opposing elastic retraction occurs along the length of the flap. Excessive retraction can promote dehiscence or distortion of the distant wound margin. This must be anticipated before a single pedicle advancement flap is employed in cases in which postoperative tension could distort neighboring structures (e.g., eyelid margins). In these areas, a transposition flap would be a better option.

> The single pedicle advancement flap (SPAF) primarily closes wounds by stretching over the defect. Postoperatively, the collagen fibers will exert a traction force that has the potential to distort the recipient bed. The bottom line is use this flap with caution around areas where mild retraction of the flap could distort function. *This problem is most commonly noted when a SPAF is elevated perpendicular to the eyelid margin to close a problematic cutaneous eyelid defect. Consider the use of a 90 degree transposition flap in its place.*

ROTATING (PIVOTING) FLAPS

Rotation flaps, transposition flaps, and interpolation flaps are the three basic flaps that rotate on a pivot point. The rotation flap is a semicircular flap that rotates into the adjacent recipient bed (see Plate 39). Single or paired flaps can be employed to close triangular defects. As a general rule, no secondary defect is created with the rotation flap in the dog or cat .

The transposition flap is a rectangular pedicle graft commonly rotated within 90 degrees of the wound's axis. (See Plates 36 and 37.) The transposition flap is the most useful of the rotating flaps (Figs. 11-3 through 11-9). Z-plasty, a modification of the transposition flap, is discussed in Chapter 9. A modification of the transposition flap technique is exemplified by the forelimb fold flap (see Plate 40).

> The 90-degree transposition skin flap is by far the most useful flap technique available to close a variety of the small- to moderate-sized problematic wounds.

The interpolation flap is a rectangular flap rotated into a nearby, but not immediately adjacent, defect. (See Plate 38.) A portion of the flap must pass over the skin between the donor and recipient beds. The exposed subcutaneous surface of this flap segment is usually left

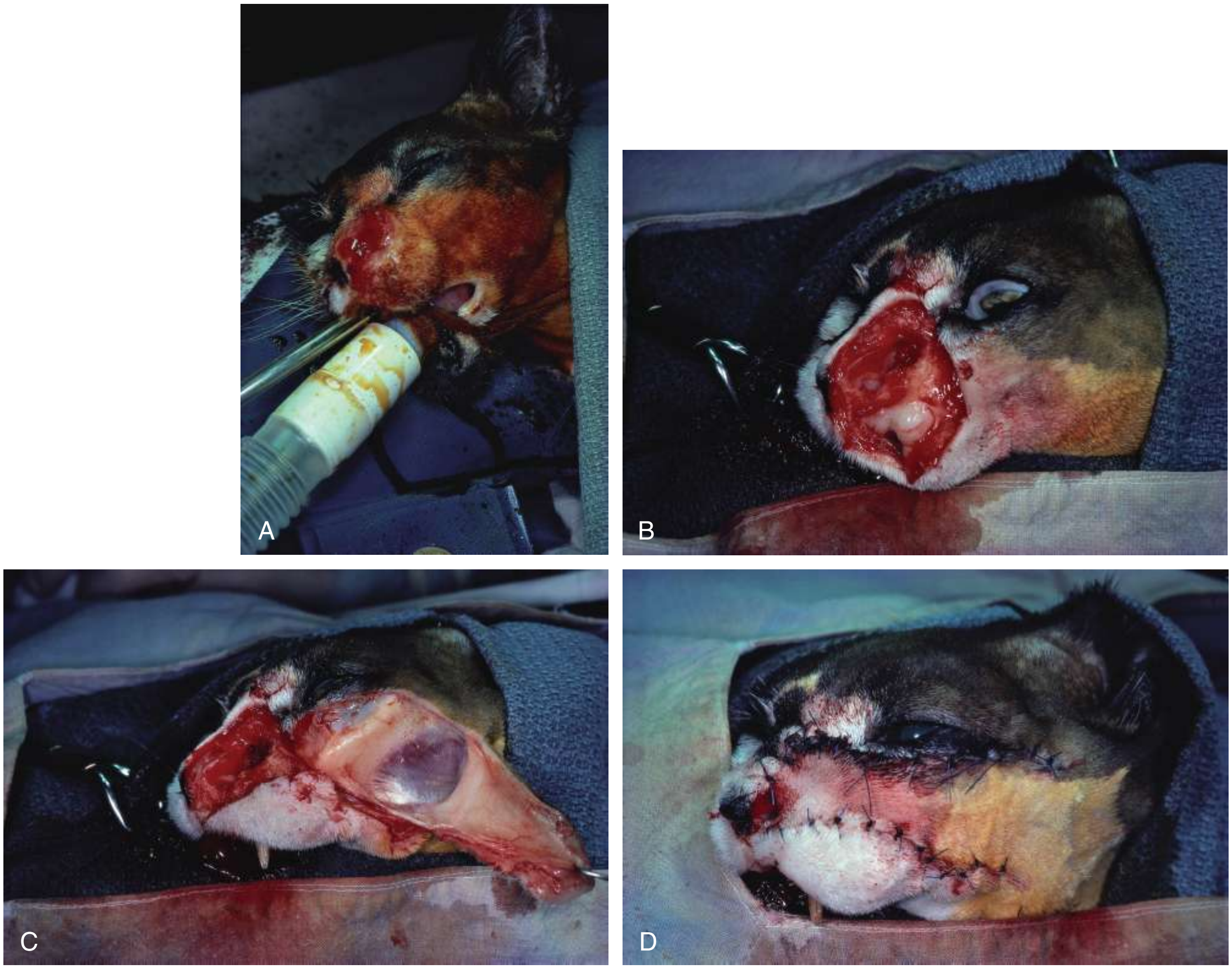

FIG. 11-1 (A) Squamous cell carcinoma involving the left nasal planum and adjacent skin. (B) Wide resection of the mass, including underlying bone. (C) Closure of lower gingival-labial mucosal defect. Staged elevation of a single pedicle advancement flap below the platysma muscle layer. (D) Closure of this wound, with the advancement flap, underscores the considerable cutaneous elastic advancement present in most feline patients.

FIG. 11-2 (A) Bipedicle advancement flap used to cover a large skin defect overlying the calcaneus. A Schroeder-Thomas splint was used to immobilize the tarsal area until incisional healing was complete. (B) A release incision is a bipedicle advancement flap by design. Note that the flap provides durable full-thickness skin coverage over this potentially problematic bony prominence. The exposed lateral (donor area) and medial granulation beds quickly healed by second intention.

FIG. 11-3 (A) Skin loss over the calcaneus in a Doberman. Skin loss of this magnitude over a bony prominence is unlikely to heal by second intention without surgical intervention. (B) Sufficient circumferential skin was available to facilitate closure of this defect, using a 90-degree transposition skin flap. The donor area closed primarily. See Figure 11-2 as an alternative option, depending on the availability of loose, elastic skin.

FIG. 11-4 (A) Cutaneous neoplasm involving the distal left tibiotarsal area. (B) Excision of the mass. (C) Rotation of a 90-degree transposition flap. (D) Closure of the donor and recipient beds. Developed after careful measurement, the transposition flap can be effectively employed for many of the smaller- to moderate-sized defects of the limbs.

FIG. 11-5 (A) Benign neoplasm involving the right nasal region. (B) Resection of the tumor. (C) Closure with a 90-degree transposition flap. Note that skin laxity of the muzzle is at a right angle to the axis of the skull. The 90-degree transposition flap is ideally suited to closing smaller problematic defects in this general region.

FIG. 11-6 (A) Antecubital skin defects can be challenging to close. (B) Marking pen used to outline a 90-degree transposition flap, parallel to the long axis of the limb. (C) Successful closure. An Elizabethan collar was used to prevent licking. Severe exercise restriction was imposed until suture removal 2 weeks later.

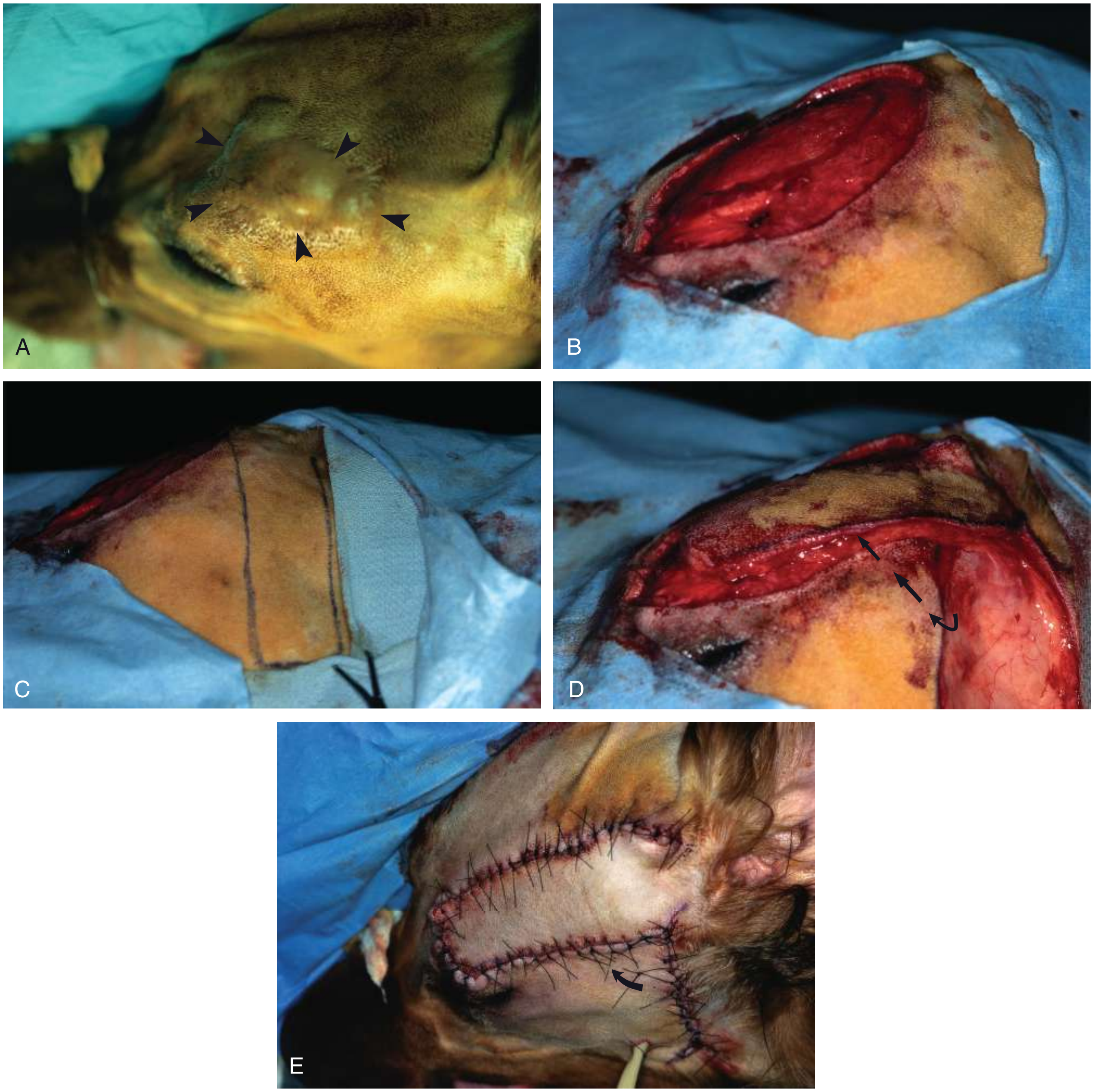

FIG. 11-7 (A) Expanding granulomatous mass in a 1-year-old Irish setter. (B) Mass resection. (C) Outline of a 90-degree transposition flap along the left lateral facial area. (D) Rotating the flap into position. Based on local tissue elasticity, the skin flap could be shortened 2 cm to help assure complete flap survival. (E) Closure was achieved without distorting the function of the upper eyelid. Due to the surgical dead space, a drain is important to prevent seroma formation.

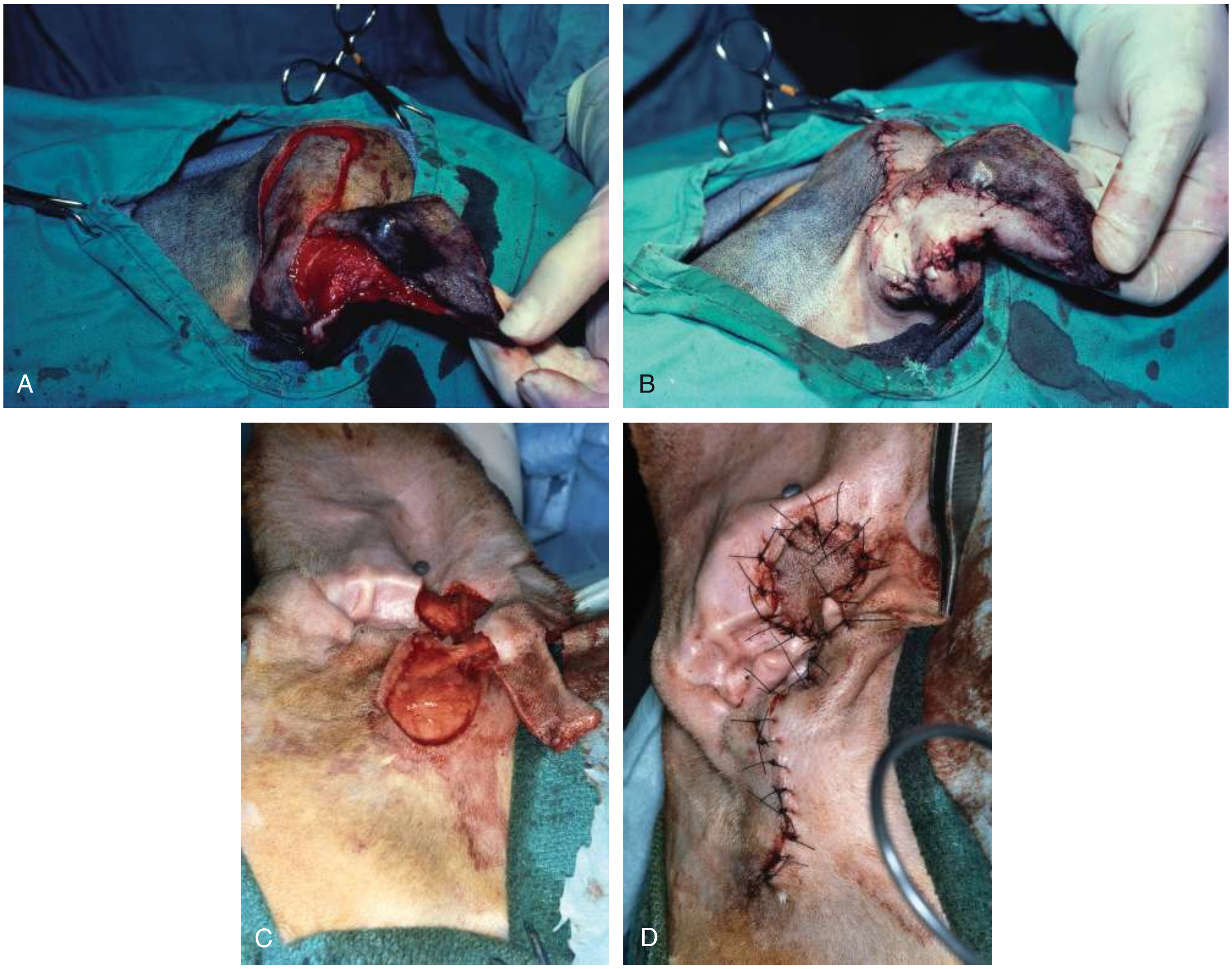

FIG. 11-8 Two examples of transposition flaps for closure of pinnal defects. (A) Loss of the caudal aspect of the pinna secondary to a bite wound in a German shepherd. Note the incisional outline of the flap. (B) Completion of closure. Note the effectiveness of this simple flap technique to reconstruct the pinna. (C) Resection of a small mast cell tumor, including the underlying cartilage proximal to the external ear canal. Elevation of a transposition flap. (D) Successful closure (see Plate 132).

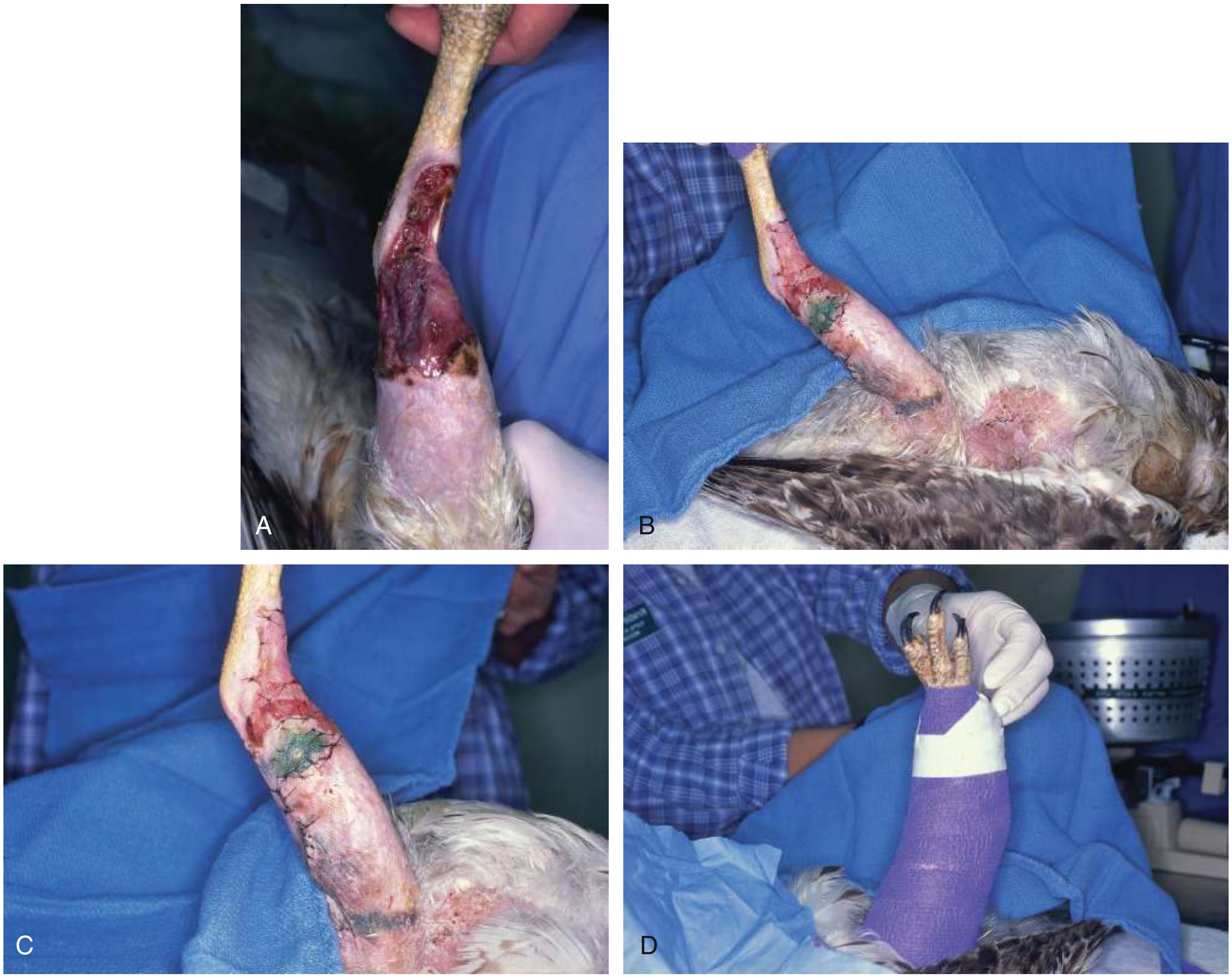

FIG. 11-9 (A) Limb wound in a red-tailed hawk. Open wound management was performed until a healthy granulation bed formed.
(B) Closure of the wound was accomplished with a 90-degree transposition flap (upper area) and a full-thickness free graft (lower area). The free graft was harvested from the left lateral thorax.
(C) Complete survival of the graft and flap. The small remaining defect healed by second intention healing.
(D) The grafted leg was protected with a partial fiberglass cast. The rehabilitated hawk was later released. Note how flap and graft techniques are applicable to a variety of species.

open, although it may be covered temporarily with a free graft. This redundant portion of the flap is later excised once healing onto the recipient defect is complete. A second option is the use of a bridge incision discussed in Chapter 13, Plate 55. Interpolation flaps are uncommonly employed in veterinary medicine, although this general design is employed in tubed flaps and some axial pattern flap techniques.

Think local flap first before considering more elaborate flap techniques. For example, a dorsal cranial defect can be closed by a caudal auricular axial pattern flap (CAAPF). Half the length of the CAAPF is needed simply to traverse the area between the base of the flap and the caudal border of the defect. In contrast, a smaller transposition flap developed adjacent to the pinna can cover the defect completely. The transposition flap is smaller, easier to elevate, and the time associated with skin closure is less.

Suggested Readings

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