



Figure 3-22. "Biologic tourniquet" resulting from skin being closed under too much tension (between arrows) with swelling distal to the "tourniquet".



Figure 3-23. Contractural flexion of the carpus resulting from tension caused by second intention healing of a large open wound on the flexion surface or the carpus. (From Swaim SF, Hinkle SH, Bradley DM: Wound Contraction: Basic and clinical factors. *Compend Contin Edu Vet Pract* 23: 29, 2001.)

techniques which the author has found beneficial in dealing with such wounds. It will include the topics of 1) undermining, 2) various tension sutures, 3) closure of various shaped wounds that may commonly be encountered on the distal limbs where tension may be a factor, and 4) management of wounds over the carpus and tarsus.

Undermining

Definition and Indications

Undermining of skin on the distal limb is done using scissors or a scalpel to separate the skin from underlying structures. The full elastic potential of the skin can then be utilized to stretch it in wound closure endeavors.

Undermining is indicated to relieve skin tension prior to apposing wound edges, to isolate vessels and nerves

within a wound, and to release the skin from underlying dense scar tissue at the edge of chronic wounds.

Techniques

Skin is undermined parallel to the anticipated direction of skin advancement. Blunt undermining may be performed by advancing closed scissor blades beneath the skin to the depth of undermining and then opening them (Figure 3-24A). The scissors are withdrawn from under the skin with the blades still open. For undermining on the distal limb, curved blunt-blunt scissors (i.e. Metzenbaum scissors) are effective. The curve of the scissors is placed against the curve of the limb for most effective use. Because a relatively small area will be undermined, the points of the scissors will primarily be used in the procedure. The blunt end of a scalpel handle may also be inserted under the skin and moved back and forth as a means of blunt dissection (Figure 3-24B). Undermining should be done in the loose areolar fascia deep to the dermis to preserve blood supply to the skin. If skin has been recently traumatized it should be undermined gently because the additional insult to the skin vasculature could result in slough. When the status of the skin vasculature is questionable, delayed primary closure is indicated after resolution of contusions, edema and infection.

Sharp-sharp scissors can be used for fine dissection around specific structures such as vessels and nerves. The need for such dissection is more prevalent on the distal limb where such structures are abundant. The scissor points delicately engage the connective tissue around such structures with minimal pressure. When the blades are opened they separate the tissue atraumatically. The surgeon should be careful not to close the scissors until the points are well retracted from the wound to help assure that no vessels or nerves are inadvertently cut.

Sharp undermining may be performed by carefully snipping dense fascial attachments with scissor blades (Figure 3-24C). The procedure is often combined with blunt scissor undermining. This type of undermining on the distal limb would most likely be used in the presence of dense scar tissue under the skin. Small amounts of tissue would be snipped at a time, using care not to damage nerves or vessels in the area. Sharp undermining of skin adherent to underlying fascia by dense scar tissue may also be performed using a scalpel blade to cut the dense connective tissue parallel to the undersurface of the skin (Figure 3-24D). Again, care must be used on the distal limb not to damage vessels and nerves. Care must also be used not to undermine too shallow when cutting through dense scar tissue at

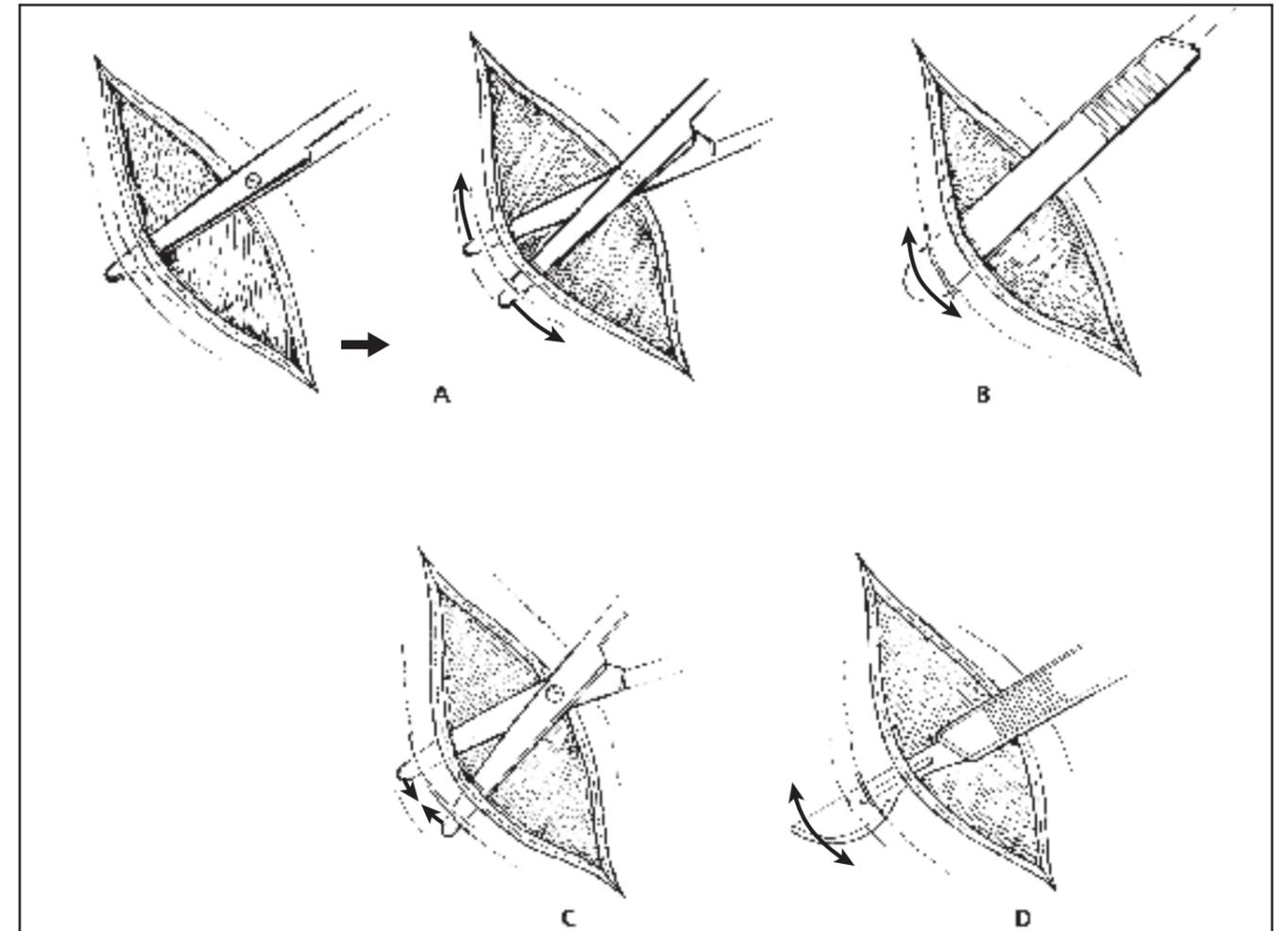


Figure 3-24. Techniques for undermining. A. Blunt undermining with scissors. B. Blunt undermining with a scalpel handle. C. Sharp undermining with scissors. D. Sharp undermining with a scalpel blade. (After Swaim SF, Henderson RA: *Small Animal Wound Management*, 2nd ed.: Baltimore: Williams & Wilkins, 2997, 151.)

the skin edge. If skin is undermined too thin through this scar tissue, its vasculature may be damaged.

When undermining is to be done around a wound that is being treated by secondary closure, it is necessary to free the skin edges from their attachment to underlying granulation tissue. This is done by incising and removing any epithelial tissue that is present at the wound edge. The epithelium is incised around the wound at its attachment to the granulation tissue and at its juncture with haired skin. A number 15 scalpel blade can then be used to undercut the epithelium for its removal. The cleavage plain between the dermis and underlying structures is located and undermining continues in this plain. Granulation tissue in the center of the wound is left intact and wound closure is over it.

When undermining skin, atraumatic surgical technique should be used. Crushing instruments such as Allis tissue forceps should be avoided. Brown-Adson thumb forceps, skin hooks, or stay sutures should be used to

manipulate skin. A simple skin hook can be made by bending the point of a hypodermic needle with needle holders to form a hook. The hooked needle is held in needle holders to serve as a skin hook (Figure 3-25).

As undermining progresses, periodic attempts should be made to approximate the wound edges to determine if tension relief is adequate. Excessive bleeding may be controlled by electrocoagulation or ligation. However, skin tension and bandaging usually control hemorrhage and prevent seromas. If there is concern whether these will control hemorrhage, or whether dead space will result in a seroma or hematoma, a ¼-inch diameter Penrose drain should be placed under the undermined skin to help prevent seroma or hematoma formation.

Aftercare

An absorbent bandage should be placed over the wound area to protect the wound. If a drain has been