BIOPSY OF SKIN AND NAIL

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INTRODUCTION

A biopsy of skin or its related structures is often necessary to establish a diagnosis, confirm a diagnosis, or to ensure complete excision of a neoplastic lesion. The information gained in performing a biopsy is only meant to aid the clinician in the treatment of a disease process, thus a biopsy is a tool by which the histopathologic process of a disease is assessed and treatment directed. In addition, a biopsy is an invasive procedure with associated risks, and the decision to obtain a tissue sample must be made after the clinical condition has been thoroughly assessed and a differential diagnosis established.

BIOPSY PLANNING

The planning of a skin or nail biopsy should include such factors as the site, size, stage of progression, depth of tissue resection, as well as the timing of performing a biopsy. In general, a small and representative portion of the lesion or eruption should be sampled, with consideration given to specific anatomic landmarks to be avoided. The upper leg should be chosen over the plantar aspect of the foot when possible, especially when a generalized eruption is present.

When there are multiple lesions present in various stages of development, a site should be chosen which represents a well-developed lesion, avoiding early and late stages of the disease process. The exceptions to this rule include vesicular, bullous, and pustular lesions, which should be biopsied in an early stage lesion (less than 24-48 hours old).

A variety of dermatologic biopsy techniques have been described, and the clinician must be familiar with the indications, technique, and risks inherent to each method. The most commonly employed techniques include: shave biopsy, curettage, scissors biopsy, punch biopsy, incisional biopsy, and excisional elliptical biopsy. The choice of biopsy technique is dependent upon the suspected pathologic condition which is present, as this will dictate the size and extent of tissue sampling. Conditions limited to the epidermis or upper dermis (keratoses, verrucae) are easily biopsied by means of a shave technique. Deep seated lesions, on the other hand, require a full depth incisional biopsy of the affected area including subcutaneous fat, as many of the dermatoses are characterized by histopathologic changes in the deep dermis or subcutaneous tissue.

Eruptions with an aggressively progressing border require an elliptical resection which includes normal and affected tissue of sufficient depth to include subcutaneous fat. Likewise, in cases where an infectious process is suspect, appropriate bacterial, fungal, and viral cultures should be obtained.

SPECIMEN FIXATION AND TRANSPORT

Following the procurement of a tissue sample, the specimen must be transported to the laboratory in a clearly labeled container, and in an efficient manner to assure proper fixation and prevent desiccation. Large tissue samples can be safely wrapped in a moist sterile sponge for 15-20 minutes before being placed in a fixative solution. An appropriate fixative medium for transport is a phosphate buffered solution of 10% formalin, which is the standard fixative for paraffin-embedded histopathology. The volume of fixative to specimen ratio is 20:1, thus large specimens require a sufficient volume of solution in an appropriately-sized container. In instances where a special study is to be performed, such as immunohistochemical staining or electron micro-

scope analysis, a specific fixative other than formalin is required, and a pathologist should be consulted prior to the collecting of the specimen to assure appropriate tissue handling.

SKIN BIOPSY TECHNIQUES

Shave Biopsy

A shave biopsy is intended to remove lesions which are isolated to the superficial layers of skin (epidermis, upper dermis). The typical lesion suitable for shave biopsy is a raised, exophytic growth which does not penetrate the deep layers of the dermis. This includes verrucae, seborrheic and solar keratoses, compound nevi, and non-pigmented skin cancers such as a basal cell carcinoma. A shave biopsy should be performed between the deep papillary dermis and mid-reticular dermis, thus leaving a base of dermal cells for epithelial healing, without scar formation.

A shave biopsy is performed with the use of either a hand-held double-edged razor blade or scalpel. A hand-held razor blade is more difficult to use, as the blade must be curved between the thumb and forefinger to create an arc in the blade. This allows for a tapered U-shaped excision of the lesion, however too much pressure will gouge the central portion of the biopsy site, and predispose the area to scarring.

A scalpel, on the other hand, is more rigid than a razor blade, and requires that the skin surface be raised (by injection of a local anesthetic, or pinching of the skin) to assure sufficient depth of penetration and appropriate tapering of the biopsy margins. A scalpel shave biopsy is most commonly performed with a #10 or #15 blade, depending on the size of the lesion. The skin is pinched between the thumb and forefinger to create a convex surface, and the blade is swept over the raised lesion, parallel to the skin. (Figure 1) In this manner, a controlled depth excision is performed. Care must be taken to avoid sawing through the skin, as this creates a jagged surface with uneven margins. Hemostasis is obtained by the application of a styptic, such as aluminum chloride (35% in 50% isopropyl alcohol).

Curettage

Curettage is indicated for the removal of superficial benign lesions such as verrucae and keratosis. This method of biopsy is the least desirable for histopathologic examination since the removed tissue is often shredded and fragmented, thus destroying its cellular architecture. Curettes are available in a variety of sizes, ranging from 2 mm to 6 mm. The cutting edge of a curette is ideal for scooping out lesions, as the underlying dermis, which is more firm and adherent than the overlying epidermis, serves to restrict the depth of dissection.

After anesthetizing and cleansing the biopsy site, a curette is used to scrape the lesion at its base by applying a firm, downward, scooping motion, drawing the cutting edge parallel to the skin. (Figure 2) The edges of the lesion are also debrided in a circumferential manner until a clean margin appears. Hemostasis is obtained and the wound dressed.

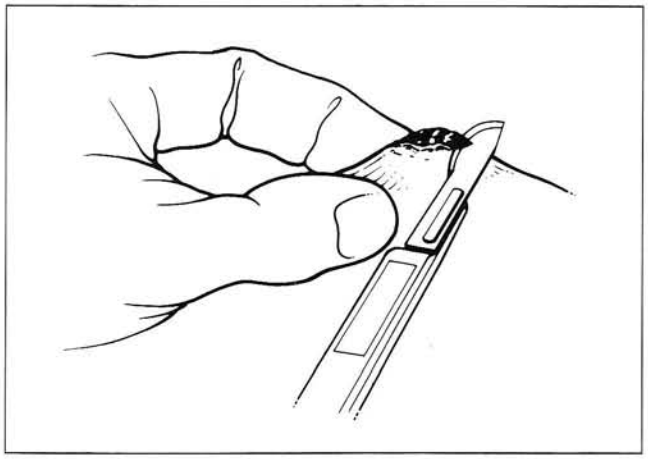

Figure 1. Shave Biopsy. The lesion is elevated by pinching the skin between the thumb and index finger. A scalpel is used to excise the lesion.

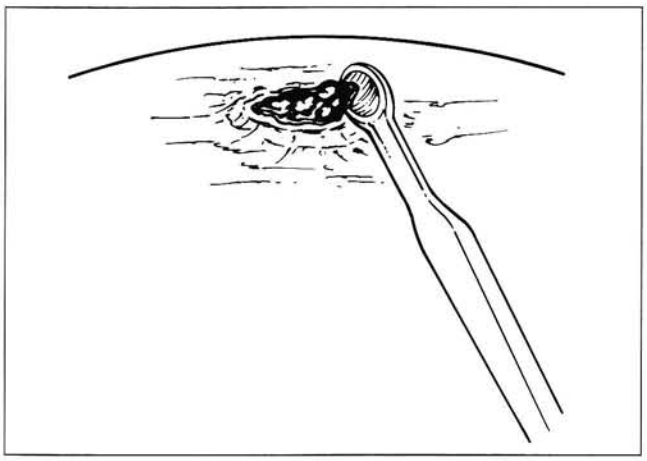

Figure 2. Curettage Biopsy. A firm, downward motion is used to scrape the lesion from the underlying basement membrane.

Scissors Biopsy

Biopsy of a pedunculated, raised lesion (skin tag, nevi) can be performed in an efficient manner through the use of a scissors technique. After anesthetizing the area with a local injection, the lesion is grasped with a toothed forcep, and the base snipped with an iris scissors. (Figure 3) Hemostasis is obtained by applying aluminum chloride (35%) or trichloroacetic acid (50%), followed by a light dressing.

Punch Biopsy

A punch biopsy is one of the most common and basic techniques performed. Based on the size of the lesion and instrument used, this technique can be either incisional (sub-total excision) or excisional (total removal of lesion). There are a variety of sizes of punches available, ranging from 2 mm to 6 mm in diameter, and most of the instruments used today are disposable. The use of a disposable punch assures that the punch will always be sharp, and eliminates the need for cleaning and re-sterilization.

The technique of performing a punch biopsy begins with anesthetizing the site of the lesion by local infiltration of an anesthetic agent beneath the skin, (Figure 4A) and usually requires less than 2.0 cc of solution. The local anesthetic should be a quick-acting agent (lidocaine), and epinephrine can be used to aid local hemostasis. The skin is cleansed with alcohol prior to performing the biopsy. The punch is then applied perpendicular to the skin, which is stabilized with the thumb and forefinger of the other hand. Using firm and steady pressure, the punch is rotated back and forth while penetrating the skin. (Figure 4B) Upon removal of the punch, the cylindrical section of skin remains attached to the underlying subcutaneous fat. The specimen is then stabilized by either grasping it gently with a thumb forcep, or spearing it with a hypodermic needle. It is then sharply excised at the base with either a scalpel or scissors, (Figure 4C) and immediately placed in a fixative solution. Hemostasis is obtained by applying direct pressure to the biopsy site, or through the use of a chemical agent such as silver nitrate or trichloroacetic acid (25%). The defect in the skin is then sutured closed, and a light dressing applied.

The use of a cylindrical punch leaves a round defect in the skin, and suturing often causes a puckering of the skin at the margins of the defect. (Figure 4D) An alternative method is to apply longitudinal traction on the skin prior to excising the lesion. The remaining defect, upon relaxation of the skin, is oval in shape with the long axis of the incision perpendicular to the direction of traction. (Figure 4E) This facilitates suture closure in that there is less tension on the skin margins, resulting in a more cosmetically-acceptable scar.

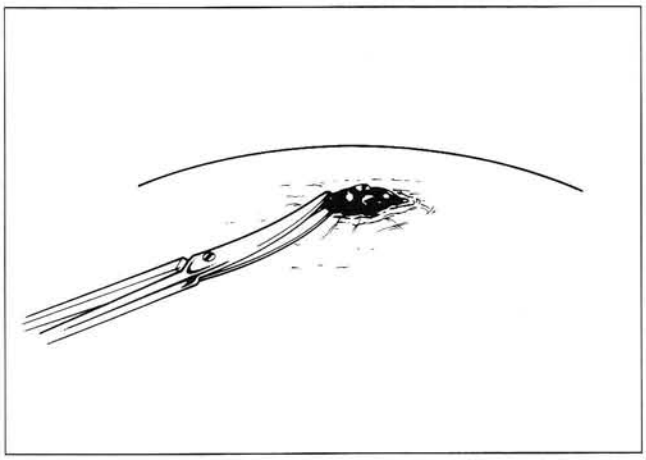

Figure 3. Scissors Biopsy. The raised lesion is anesthetized, and an iris scissors is used to excise the lesion at its base.

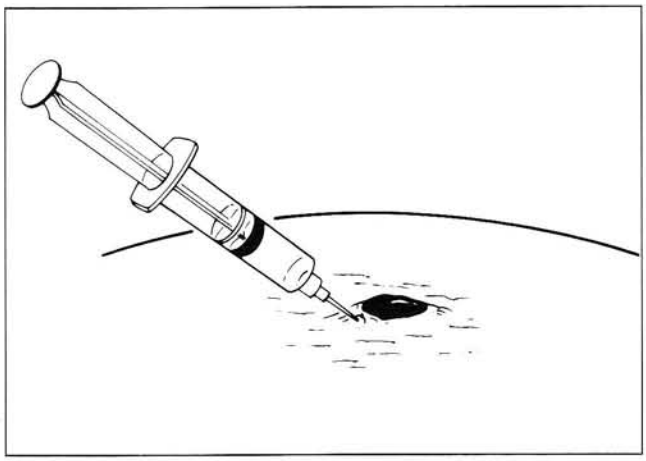

Figure 4A. Punch Biopsy. A local anesthetic is injected deep to the lesion.

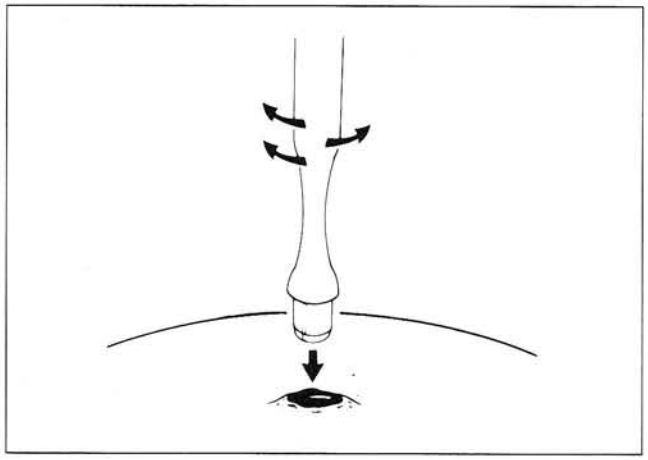

Figure 4B. A punch is used to circumscribe the lesion by applying firm pressure, while rotating the instrument back and forth.

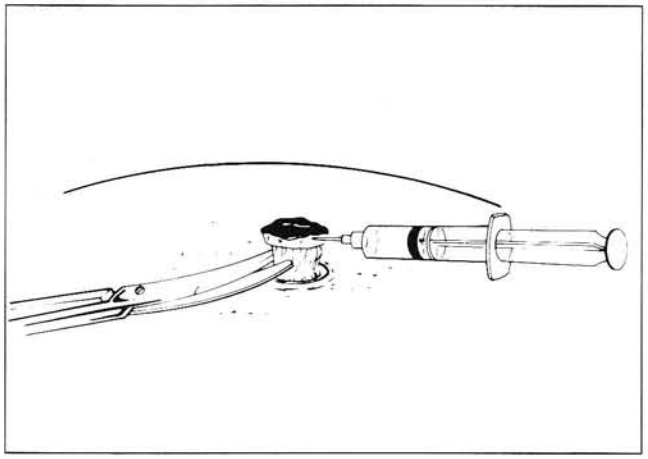

Figure 4C. The biopsy specimen is stabilized with a needle, and resected at its base.

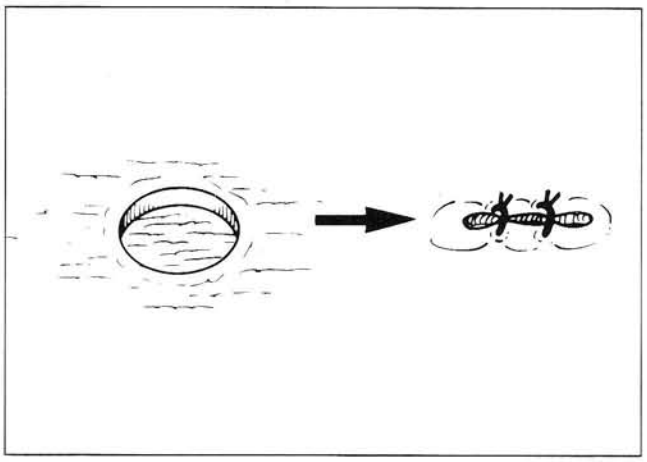

Figure 4D. Suturing of a round defect leads to puckering at the edges of the wound.

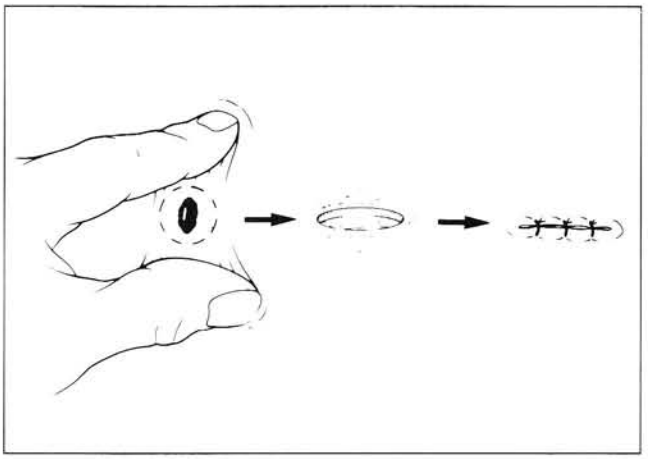

Figure 4E. Longitudinal tension on the skin prior to punch biopsy yields an oval skin defect. Suturing of this defect produces a tension-free closure.

Elliptical Incision/Excision Biopsy

A large or deep-seated lesion frequently requires an incisional biopsy in order to make or confirm a diagnosis. Similarly, suspected malignant growths are often best treated by total excision. The benefit of obtaining an uninvolved margin of skin is also evident when examining eruptive lesions, thus elliptical excisions serve to distinguish between normal and diseased tissue.

Removal of a fusiform section of skin facilitates closure of a relatively large defect, however, these invasive resections heal with a visible scar, and the risk of complication increases. Wound infection, dehiscence, and unsightly or painful scar formation are not uncommon to this type of procedure.

A well-planned surgical excision of a cutaneous lesion requires a clear understanding of the anatomy of the area in question, as tissue mobility and skin thickness varies greatly in different regions of the lower extremity. A properly performed fusiform excision requires that the length to width ratio be at least 3:1, as this will facilitate closure of the wound by preventing excessive tension on the skin margins. In addition, the angle at the tips of the incision should be no greater than 30°. (Figure 5A) When possible, incision placement should be made parallel to or within relaxed skin lines, as this will ultimately result in a more cosmetically acceptable scar.

The incision approach should be drawn with a surgical marker prior to the injection of an anesthetic agent, so as to prevent distortion of the operative site. The extremity is then cleaned with an appropriate agent (Betadine or Hibiclens scrub), and sterile draping performed. The

incision is made with the blade perpendicular to the surface of the skin, without skiving (angling) the blade. This will facilitate level apposition of the skin margins and prevent overlapping during closure. Care is also taken to penetrate the entire layer of dermis with the initial cut, avoiding multiple incisions in the same surgical layer. Attention is directed to the tips of the fusiform ellipse of skin, where incomplete penetration through the skin frequently requires further revision of the initial cut. By beginning and ending each incision with the blade's handle held upright, one can prevent making too shallow of a cut at the tips of the incision. (Figure 5B) Using a thumb forcep, the wedge of skin is grasped (away from the lesion), and dissected off of the base of the underlying fascia. (Figure 5C) In cases where the disease process penetrates into deeper tissue, the dissection should also include this tissue for diagnostic purposes.

After the wedge of skin has been excised, there is often tension on the wound which causes the margins to gap open. Tension is caused by the deep attachments of the skin to the underlying fascial layers. Undermining of the skin reduces this tension by separating attachments to the underlying fascia. A general rule regarding the depth of undermining is that all skin margins should be undermined a distance which equals the width of the excised wedge of skin, or greater (for a 1 cm x 3 cm wedge resection, each border is undermined at least 1 cm). Blunt dissecting scissors are used to perform this technique, (Figure 5D) which is a combination of repeated spreading and cutting of tissue. Care is taken when undermining to prevent inadvertent damage to neurovascular structures, which are abundant in this tissue plane. Hemostasis is usually obtained through the application of direct pressure, however, larger vessels must be identified and either electrocoagulated or tied off with a suture ligature.

Closure of the biopsy site should include reapproximation of the subcutaneous layer (superficial fascia). The goal of the subcutaneous closure is to reapproximate the skin edges, so that the subsequent skin closure is free of tension, thus preventing excessive scar formation. Skin closure is performed with an appropriate method, (Figure 5E) and a light compressive dressing applied.

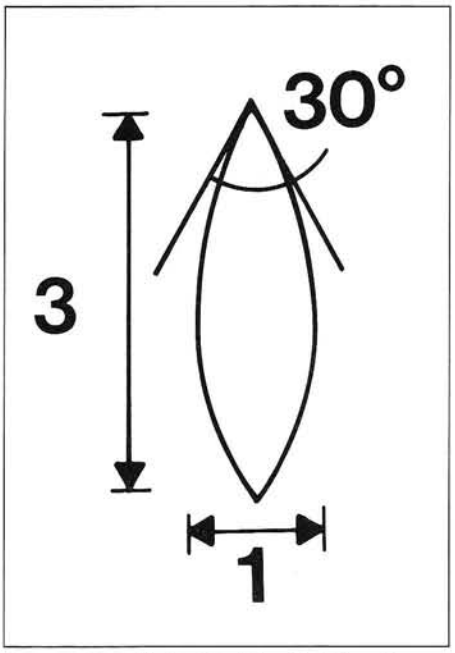

Figure 5A. Elliptical Incision/Excision Biopsy. Incision orientation with appropriate length:width ratio and tip angle.

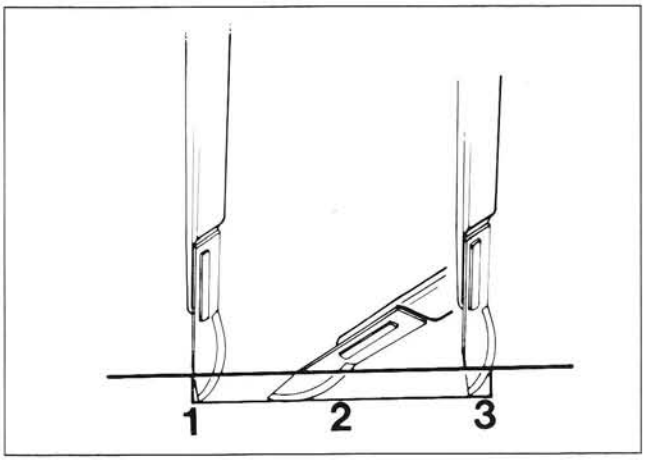

Figure 5B. Proper orientation of scalpel blade, entering and exiting the skin perpendicular to the skin's surface.

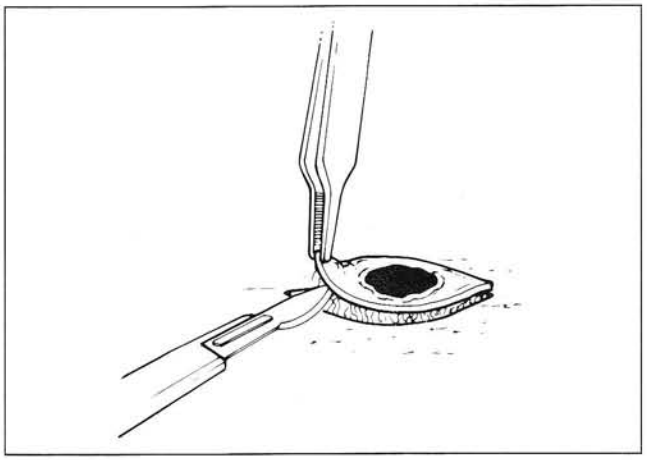

Figure 5C. Sharp dissection of the skin wedge from the underlying fascia.

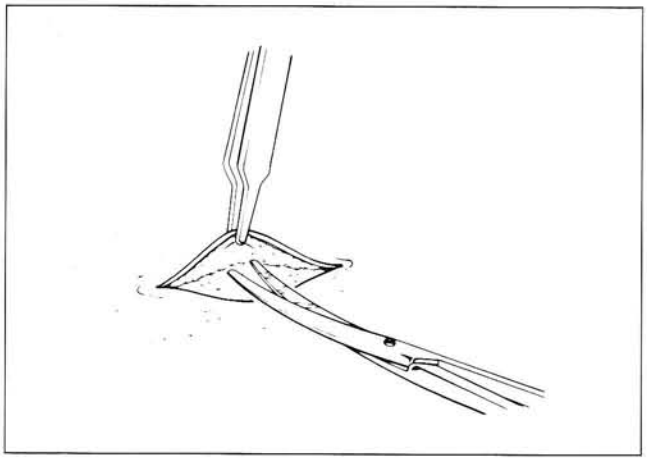

Figure 5D. Undermining of the skin margins with blunt scissors.

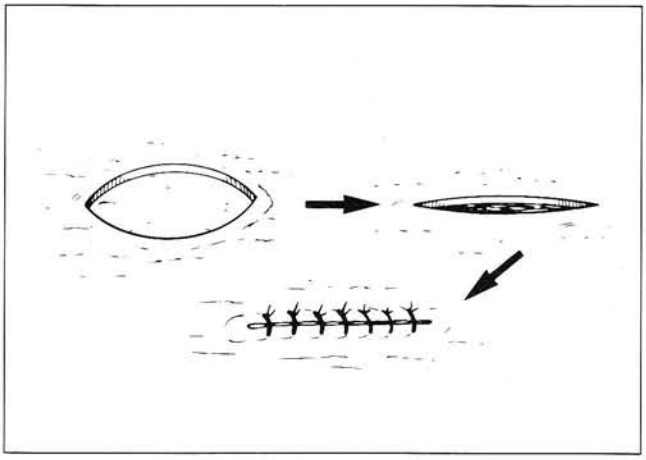

Figure 5E. Skin closure with minimal tension on the skin margins.

NAIL BIOPSY

Diagnostic nail surgery is performed in instances where there is a suspicious lesion either in close proximity to the nail plate, or beneath the nail plate (on the nail bed). As with any skin biopsy technique, one must adhere to the principles previously outlined. The lesion must be evaluated, based on size, texture, color, and location, and an appropriate width and depth of tissue collected.

Specific anatomic considerations are inherent to the nail and its associated structures, and a thorough understanding of this anatomy will facilitate proper biopsy collection. The visible nail plate, which is only a portion of that which is present, is a manifestation of the underlying nail matrix. Access to the matrix, nail folds, or nail bed, thus requires that the nail plate be removed prior to obtaining a biopsy specimen.

Numerous nail avulsion techniques have been described, most of which involve the use of blunt instrumentation to lift the nail plate from the underlying nail bed. Following the delivery of anesthesia and avulsion of the nail plate, the digit is vigorously cleansed to reduce the bacteria count. Adherence to aseptic technique is imperative when obtaining a biopsy specimen in this region, as the proximity of the underlying phalanx predisposes to complicated infections (osteomyelitis). The most common areas biopsied include the nail bed, nail fold, and nail matrix.

Nail Bed Biopsy

When performing a biopsy of the nail bed, a punch biopsy is often the preferred method, as this provides a full-depth section of skin to the level of periosteum. The resultant defect is rarely sutured closed, since the skin overlying the phalanx is thin and firmly adhered to the underlying bone. These wounds heal through the formation of granulation tissue, and eventual re-epithelialization occurs with minimal scar formation.

Nail Fold Biopsy

Longitudinal elliptical excision of a nail fold lesion provides an adequate width and depth of tissue resection. With this method, one has the option to close the wound primarily with either sutures or Steri-strips. Healing is rapid with few complications and minimal scar formation.

Nail Matrix Biopsy

A nail matrix biopsy should be performed with either a punch biopsy or elliptical excision technique. Additional exposure to the nail matrix often requires making an incision into the proximal nail fold. The nail fold is retracted proximally to gain access to the underlying matrix, and the biopsy specimen is excised to the level of bone. This type of biopsy will result in a defect in the nail plate upon regrowth of the nail, and one may opt to surgically excise a portion (or all) of the matrix at the time of biopsy. This will prevent a partial regrowth of the nail, which can become problematic.

WOUND COMPLICATIONS

A variety of wound complications can be encountered following a skin biopsy. In general, the more invasive procedures have a greater risk of complications. The most common postopera-

tive complications include excessive pain, infection, hematoma, wound dehiscence, nerve entrapment, and excessive scar formation (hypertrophic scar, or keloid). Meticulous attention to incision placement, atraumatic technique, exact hemostasis, and sterile technique will greatly reduce the incidence of postoperative complications.

SUMMARY

The proper collection of a skin or nail biopsy requires a clear understanding of the anatomy of the skin and its related structures. One must first establish a differential diagnosis of the suspected lesion based on anatomic location and lesion characteristics (size, depth, color). Once the decision to biopsy is made, an appropriate technique should be employed to facilitate diagnosis of the lesion. Furthermore, appropriate tissue handling, wound hemostasis, and aseptic technique, will reduce the incidence of postoperative wound complication.

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