CLINICAL REVIEW

Skin Biopsy Techniques for the Internist

Patrick C. Alguire, MD, Barbara M. Mathes, M.D.

OBJECTIVE: To review three commonly performed skin biopsy procedures: shave, punch, and excision.

DATA SOURCES: English-language articles identified through a MEDLINE search (1966–1997) using the MeSH headings skin and biopsy, major dermatology and primary care textbooks, and cross-references.

STUDY SELECTION: Articles that reviewed the indications, contraindications, choice of procedure, surgical technique, specimen handling, and wound care.

DATA EXTRACTION: Information was manually extracted from all selected articles and texts; emphasis was placed on information relevant to internal medicine physicians who want to learn skin biopsy techniques.

DATA SYNTHESIS: Shave biopsies require the least experience and time but are limited to superficial, nonpigmented lesions. Punch biopsies are simple to perform, have few complications, and if small, can heal without suturing. Closing the wound with unbraided nylon on a C-17 needle will enhance the cosmetic result but requires more expertise and time. Elliptical excisions are ideal for removing large or deep lesions, provide abundant material for many studies, and can be curative for a number of conditions, but require the greatest amount of time, expertise, and office resources. Elliptical excisions can be closed with unbraided nylon using a CE-3 or FS-3 needle in thick skin or a P-3 needle on the face. All specimens should be submitted in a labeled container with a brief clinical description and working diagnosis.

CONCLUSIONS: Skin biopsies are an essential technique in the management of skin diseases and can enhance the dermatologic care rendered by internists.

KEY WORDS: skin biopsy; shave biopsy; punch biopsy; excision biopsy; internists.

J GEN INTERN MED 1998;13:46–54.

The skin biopsy is a relatively simple, but essential procedure in the management of skin disorders. Properly performed, it may confirm a diagnosis, remove cos-

metically unacceptable lesions, and provide definitive treatment for a number of skin conditions. Skin biopsies are unique because the lesion can be visualized, allowing for proper selection of biopsy site and technique. Skin biopsies can be performed with minimal risk in critically ill patients, and a timely skin biopsy may avoid other, more invasive procedures.

Skin biopsies are infrequently performed by internists.¹ This may reflect lack of proficiency, or uncertainty regarding indications, choice of procedure, specimen handling, or subsequent wound care. The purpose of this review is to discuss in detail the three most commonly performed biopsy procedures: shave, punch, and excision.

METHODS

English-language articles identified through a MEDLINE search (1966–1997) using the MeSH headings skin and biopsy, major dermatology and primary care textbooks, and selected cross-references were reviewed. Articles were selected if they reviewed the indications, contraindications, choice of procedure, surgical technique, specimen handling, and wound care and were relevant to internal medicine physicians wishing to learn skin biopsy techniques.

BEFORE BIOPSY

Indications

It is a maxim among dermatologists that more errors are made from failing to biopsy promptly than from performing unnecessary biopsies. Nevertheless, many dermatosis have nonspecific histopathology, and biopsy cannot substitute for good clinical skills.^{2–4} Biopsy is indicated in all suspected neoplastic lesions, in all bullous disorders, and to clarify a diagnosis when a limited number of entities are under consideration (Table 1).^{2,4,5} Biopsy can also serve as the definitive treatment for irritated, inflamed, precancerous, or malignant lesions.^{2,4–6}

Contraindications and Other Considerations

There are few absolute contraindications to skin biopsy, but all patients should be told that biopsies leave scars, and internists may wish to refer lesions involving the face (particularly the eyelids and nose), or fascia of the palms and soles, to dermatologists or plastic surgeons. In

Received from the Division of Internal Medicine (PCA) and the Division of Dermatology (BMM), University of Florida, Gainesville.

Address correspondence and reprint requests to Dr. Alguire: Health Science Center, University of Florida, P.O. Box 100277, Gainesville FL 32610-0277.

Table 1. Indications for Skin Biopsy

Indication	Clinical Presentation	Possible Diagnosis	Biopsy Technique
Diagnosis	Rashes or blisters involving dermis	Drug reaction	Punch
		Cutaneous lymphoma	
		Deep tissue infection	
		Erythema multiforme	
		Kaposi's sarcoma	
		Lupus erythematosus	
		Pemphigoid	
		Pemphigus	
		Psoriasis	
		Vasculitis	
Diagnosis and treatment	Processes involving the subcutis	Erythema nodosum	Excision
	Atypical moles and pigmented lesions	Panniculitis	
		Dysplastic nevi	
		Malignant melanoma	
		Actinic keratosis	
		Basal cell carcinoma	
		Seborrheic keratosis	
		Pyogenic granuloma	
		Skin tags	
		Squamous cell carcinoma	
	Superficial lesions	Warts	

most cases, a biopsy should not be done at an infected site, although occasionally infection may be the indication for the procedure. Inquiry should be made regarding allergies to topical antibiotics, antiseptics, local anesthetics, and reactions to tape. Patients should be asked about bleeding disorders, bleeding with previous surgery, and use of drugs known to interfere with hemostasis. With the exception of shave biopsies, patients with bleeding disorders or taking warfarin should be referred to a qualified dermatologist or surgeon, whereas patients taking aspirin can generally be managed with careful attention to hemostasis and the use of a pressure dressing, described later in this review.

Site Selection

One of the more difficult initial decisions is selecting the biopsy site. Generally, lesions with the most advanced inflammatory changes should be chosen; evolutionary changes may take several days and a too-early biopsy may reveal only nonspecific features.^{2-4,7,8} For blistering diseases, the reverse is true; the earlier the lesion, the more specific the histopathology. Consequently, only the newest vesicles and blisters should be biopsied, usually within 48 hours of their appearance.²⁻⁴ Older lesions with secondary changes such as crusts, fissures, erosions, excoriations, and ulcerations should be avoided since the primary pathological process may be obscured. For non-bullous lesions, the biopsy should include maximal lesional skin and minimal normal skin. For lesions between 1 and 4 mm in diameter, biopsy the center or excise the entire lesion. For large lesions, biopsy the edge, the thickest portion, or the area that is most abnormal in color, be-

cause these sites will most likely contain the distinctive pathology. Whenever possible, remove vesicles intact, with adjacent normal-appearing skin, because disruption makes histologic interpretation more difficult. Similarly, bullae should be biopsied at their edge, keeping the blister roof attached. If the differential diagnosis is broad, biopsy several sites to minimize sampling error.

Whenever possible, avoid important cosmetic areas, such as the face, and areas with poor healing characteristics.^{4,8,9} Hypertrophic scarring tends to occur over the deltoid and chest areas, and delayed healing can be a problem over the tibia, especially in diabetic patients or in patients with arterial or venous insufficiency.⁸ The incidence of secondary infection in the groin and axillae is high; therefore, biopsy these areas only if other sites are unavailable.³

BIOPSY

Surgical Safety

Performing skin biopsies places the operator at risk of blood-borne infections. Accordingly, vaccination for hepatitis B is indicated, and universal precautions should be observed by wearing gloves and eye-guards.¹⁰ Double-gloving may provide increased protection against blood exposure.¹¹ Shave and punch biopsies are clean, not sterile procedures; mask, gown and sterile gloves are not necessary.⁷ A mask is recommended for operators or assistants known to be respiratory carriers of *Staphylococcus* or *Streptococcus* organisms. Mask, gown, and sterile gloves are indicated for excisions, and are reasonable for any patient at increased risk of infection.⁷ Recapping used nee-

dles increases the risk of needle sticks, and should never be attempted. Used sharp objects (needles, blades, punches, razors) are disposed in approved Occupational Safety and Health Administration (OSHA) containers provided by the pathology laboratory or medical waste disposal company. Material that is contaminated with blood or other body fluids should be disposed in special, red, contaminated-materials plastic bags.

Supplies and Instruments

Increased efficiency can be achieved by gathering together the necessary supplies and instruments in a biopsy kit. The kit may be stored in a central location for use by many physicians and transported to the hospital for inpatient biopsies. A nurse can be in charge of ensuring that the kit is always properly stocked. To help with this chore, the kit can include an index card listing its contents (Table 2).

Preparing the Site

Any common skin antiseptic such as isopropyl alcohol, povidone-iodine, or chlorhexidine gluconate can be used to prepare the biopsy site.^{3,5,7} Mark the intended le-

sion with a surgical marker as it may be temporarily obliterated following injection of the anesthetic. Marking the outlines for excisional biopsies can be very helpful for the novice operator. For excisions, place a fenestrated surgical drape over the biopsy site after cleansing, but before anesthesia.

Round wounds tend to be pulled open in the direction of skin tension lines known as Langer's lines, which generally parallel the direction of collagen in the dermis.^{9,10,12} Tension lines can be demonstrated by gently compressing relaxed skin with the thumb and index finger, and wrinkle lines on the face are another good indicator. Surgical incisions placed parallel to tension lines will close more easily and cosmetically than those placed at right angles (Fig. 1).^{6,9,10,12}

Anesthesia

The most commonly used local anesthetic is 1% or 2% lidocaine. Because lidocaine is a vasodilator, small amounts of epinephrine are added to constrict blood vessels, decrease bleeding, prolong anesthesia, and limit

Table 2. Supplies and Instruments

Isopropyl alcohol, povidone-iodine, or chlorhexadine
Sterile gauze, 3 × 3 or 4 × 4, and sterile cotton-tip applicators
Cloth or plastic fenestrated drape
Syringes, 1 and 3 mL
Needles, 22-gauge (to draw up solutions), 30-gauge (for injection)
Lidocaine, 1% or 2%, with and without epinephrine. May buffer with 1 part NaHCO ₃ to 9 parts lidocaine, but must be refrigerated and disposed after 30 days.
Disposable surgical blades, 15 or 15c*
Disposable punches, 4, 6, and 8 mm*
Double-edge razor blade cut in half
Small tissue forceps (Adson 4 3/4 inch, 1 × 2 teeth, 1-mm tip)
Small tissue scissors (Gradle 3 3/4 inch or tenotomy)
Needle holders, 4 1/2 or 5 inch, smooth jaws, small tip (Webster 4 1/2 inch). Consider purchase of disposal suture kits with needle holders, forceps, and scissors included.
20% Aluminum chloride
4-0 or 5-0 Nylon on C-17 or P-3 needles (4-0 for scalp)
Packaged alcohol swabs or tissues
Antibiotic ointment or plain petrolatum
Spot and rectangular Band-Aid
Nonadherent dressings
Paper tape
Elastic wrap
10% Formalin specimen bottle
Surgical marking pen
Pathology request forms
Patient instructions

*Nondisposal instruments can be used but must be autoclaved after use.

FIGURE 1. Compressing the skin of the arm reveals the direction of Langer's lines. A diamond-shaped excision is outlined with its long axis parallel to the wrinkle lines to facilitate closure.

lido-caine toxicity.^{5,13} Avoid the use of epinephrine for acral lesions, tip of nose, or when large quantities are needed, especially in patients with cardiovascular disease.^{6,9,13} The onset of vasoconstriction is slower than that of anesthesia; plan to use this time efficiently by injecting the biopsy site first, then use the subsequent waiting period to select instruments, fill out forms, or explain follow-up care to the patient.

The sting of injection can be minimized by mixing 1 mL of NaHCO₃ with 9 mL of lidocaine, using a 30-gauge needle, and by making the initial injection perpendicular to the skin.^{3,5,10} Deep injections sting less than superficial injections, but prolong the time to adequate anesthesia.³ Small syringes (1 and 3 cc) permit easier injection and are less cumbersome to handle.

For small lesions the anesthetic can be injected directly into, or immediately adjacent to, the lesion. For larger lesions, perform a field block by placing a ring of anesthesia around the surgical site, always advancing and injecting through a site that has been previously anesthetized.^{10,14}

Selection of Biopsy Procedure

Shave biopsies are quick, require little training, and do not require sutures for closure. Lesions that are most suitable for shave biopsies are either elevated above the skin, or have pathology confined to the epidermis.^{5,7,10,15} Examples include seborrheic or actinic keratoses, skin tags, warts, and superficial basal or squamous carcinomas. Shave biopsies should not be used for pigmented lesions; if an unsuspected melanoma is partially removed, it cannot be properly staged.^{4,5,7} With shave biopsies, a small, depressed scar the size of the initial lesion is likely to occur.¹⁵

Punch biopsies are performed with round, disposable knives ranging in diameter from 2 to 10 mm, but 3 mm is the smallest size likely to give sufficient tissue for consistently accurate histologic diagnosis.¹⁶ The punch is an ideal procedure for diagnostic skin biopsy or removing small lesions, and often provides a better cosmetic result than a shave biopsy.^{3,7,15} Punch biopsies can heal by secondary intention, but punches greater than 3 mm may produce unacceptable scarring and are best closed with one or two sutures. Punch biopsies are easily mastered by most practitioners, are quick, and have a low incidence of infection, bleeding, nonhealing, or significant scarring.^{3,7,15}

Excisions are reserved for lesions that cannot be removed with a punch owing to size, depth, or location. Their main advantage is the amount of tissue that can be excised, allowing for multiple studies (culture, histopathology, immunofluorescence, electron microscopy) from one biopsy site.^{3,7} Excisions are especially well suited for removal of large skin tumors or inflammatory disorders deep in the skin, involving the panniculus. Excisions require the greatest amount of expertise and time; they almost always require sutures, and are more easily performed with an assistant.^{3,7} It is strongly recommended

that practitioners receive clinical training before attempting an excisional biopsy, or refer patients requiring an excision to a qualified dermatologist or surgeon.

Performing a Shave Biopsy

The shave biopsy can be facilitated by raising the lesion with a wheal of injected anesthetic, allowing the lesion to be propped up and stabilized between the thumb and forefinger.^{6,9,15} To shave a lesion, a number 15 blade is held parallel to the skin surface, and the biopsy is performed by using a smooth sweeping stroke rather than a sawing motion. Near the end of the excision, place the index finger on top of the lesion to stabilize and prevent tearing with the exit of the blade. The depth of the biopsy is controlled by the angle of the blade. Care should be taken to keep the blade parallel to the skin surface, avoiding irregular, deep penetration.

A double-edge razor blade cut longitudinally can also be used for shave biopsies. The razor technique has several advantages; it is sharper than most blades, the razor can be bent concave or convex with the thumb and forefinger to better conform to the surface being cut, and depth is easily controlled by increasing or decreasing the convexity of the curve (Fig. 2).

Curved scissors can be used to perform shave biopsies and tend to give specimens with slightly more depth than a scalpel blade. Curved scissors are an efficient means of removing skin tags and other small, exophytic growths.⁵ The lesion to be removed is stabilized with toothed forceps, then cut at the base.

Hemostasis

Bleeding following small shave biopsies can often be controlled with pressure alone. Persistent oozing can be stopped with 20% aluminum chloride in absolute alcohol. Other hemostatic agents, in order of increasing corrosive-

FIGURE 2. Half of a razor is curved with thumb and forefinger to perform a shave biopsy.

ness, are Monsel's solution (ferric subsulfate), trichloroacetic acid, and silver nitrate. Although Monsel's solution is more effective than aluminum chloride, it also causes more tissue destruction and, like silver nitrate, can result in skin pigmentation.^{3,10,17} For hemostatic agents to be effective, the wound must be as dry as possible, following which the agent is applied with a cotton applicator using firm pressure with a twisting motion.¹⁰ In general, excellent hemostasis following shave biopsies can be achieved in patients with bleeding disorders or in those taking warfarin or aspirin with the combined use of aluminum chloride and several minutes of direct pressure over the wound.

Performing a Punch Biopsy

Begin by determining the direction of the skin tension lines at the biopsy site. Raise an intradermal welt with the anesthetic, and select the appropriate size punch. Stabilize the skin with the thumb and forefinger, stretching it slightly perpendicular to the normal skin tension lines. This will produce an oval rather than a round wound, facilitating closure.⁴⁻⁶ Place the punch perpendicular to the skin and apply firm and constant downward pressure with a circular motion (Fig. 3). Avoid a back-and-forth twisting motion, and do not remove the punch to "check the progress," as this may result in a ragged wound and a shredded biopsy sample.^{10,15} When the punch reaches the subcutaneous fat, there is a definite "give" indicating that a full-thickness cut has been made. Remove the punch, and apply downward finger pressure at the sides of the wound to pop up the core. Completely elevate the core with gentle use of forceps or a needle tip, and excise it at its base with small tissue scissors. Apply pressure to the wound with gauze in preparation for closure. Punch biopsies of the scalp are best accomplished by using a 5-mm punch, and holding it at 20° to the surface of the scalp, roughly along the axis of the hair follicle.^{7,18} Scalp biop-

FIGURE 3. The skin is stabilized with thumb and forefinger and stretched slightly perpendicular to the skin tension lines. A punch is held perpendicular to the skin, and is rotated into the skin with a firm, constant pressure.

sies bleed profusely and usually require the presence of an assistant.¹⁸

Wounds 3 mm or less can be treated with a hemostatic agent and allowed to heal by secondary intention.⁴ Larger wounds require one or two sutures to produce a better cosmetic result.^{3,7,15} If sutures are to be used, do not apply a hemostatic agent. Contraindications to suturing include biopsies in infected or poorly healing skin; these wounds may heal better by secondary intention.⁷

Performing an Excision

After performing a field block, determine the direction of the skin tension lines. Align the long axis of the excision parallel to the skin tension lines. Using a surgical marking pen, draw an ellipse around the lesion to be excised, with 30° angles at each apex, the length three times the width, and a 2- to 5-mm margin of normal skin around the lesion.^{5,6} Holding the scalpel with a number 15 blade like a pencil, begin the incision at one apex with the blade perpendicular to the skin. As the incision progresses, use more of the belly of the blade, raising it to the perpendicular again at the next apex.⁶ For excisions larger than 1 cm, the blade should be angled away from the lesion, slightly undermining the wound edge. This will allow for easier eversion of the wound edge during closure, improving the cosmetic result and decreasing the risk of dehiscence. Avoid crosshatching the incisions at the apices, and nicking the sample. Although it is not necessary to go through the entire thickness of dermis on the first stroke, ultimately the incision must be deep enough to see subcutaneous fat when the sample is removed. Once the ellipse has been incised, carefully lift the sample edge with fine forceps and completely undermine the sample at the level of the subcutaneous fat with scalpel or scissors. Do not remove more tissue at the center than at the apices. Apply pressure to the wound with gauze in preparation for closing.

For some physicians, it will be technically easier to perform a diamond-shaped excision for small lesions, and a hexagonal-shaped excision for larger lesions.⁴ The lines of the excision can be marked with a surgical marker prior to anesthesia (Fig. 4). For diamond excisions, the blade is inserted vertically into the skin to make the four straight-line incisions of the diamond. For the hexagon, two straight and parallel lines are incised on either side of the lesion and then connected at each end by two more straight incisions to form the hexagon.

Pigmented Lesions

An important caveat regarding removal of pigmented lesions is the possibility of malignant melanoma. With this in mind, small lesions indicative of melanoma can be removed by a punch technique, provided that the lesion can be completely removed, whereas larger lesions require an excisional technique. In either case, the initial speci-

FIGURE 4. Elliptical, diamond, and hexagonal excisions and sites of initial suture placement.

men must be removed at the level of subcutaneous fat, which allows for proper staging in the event it is a melanoma. As a corollary, such pigmented lesions should never be destroyed by cryosurgery or removed by a shave technique because this impairs the ability to make an accurate diagnosis or properly stage the tumor. If a melanoma is diagnosed, the amount of tumor-free margin is determined by the depth of tumor invasion. In practical terms, this means that the original excision must be revised, usually creating wider tumor margins and extending the level of excision down to the deep muscle fascia, even if the margins of the original biopsy are free of tumor. Practitioners who have no clinical training in excisions, or in removing melanomas, should refer these patients to a qualified dermatologist or surgeon.

Processing the Biopsy Sample

For light microscopy, the specimen should be placed in a 10% buffered formalin solution provided by pathology; each specimen should be placed into a separate bottle and identified. Special studies require special handling and are listed in Table 3. Specimens less than 1 cm in greatest dimension can be adequately fixed in 30 mL of formalin, but larger specimens will require more formalin and should be sectioned to ensure adequate fixation. If a specimen is to be sectioned, clue the pathologist to the location of the lesion by sectioning through its center and marking the normal skin borders with surgical marker.

Careful attention must be paid to labeling the specimen. Include patient and physician name, date, and loca-

tion of the lesion. The latter is especially critical if more than one lesion is removed. The specimen label must match the pathology request form and the description in the medical record. On the request form, list the clinical diagnoses and give a short clinical history and description of the lesion or rash.^{4,5} If a tumor has been removed, request that the margins be checked for tumor. Whenever possible, submit the specimen to a dermatopathologist.³

Preparing the Wound for Suturing

Prior to closing excisional wounds, the edges of the wound may need to be undermined either sharply with a scalpel or bluntly with scissors. Blunt dissection is performed by advancing the closed scissors under the wound edge, and quickly spreading them open. The width of undermining varies with the size of the wound, but for most wounds, 5 to 10 mm is sufficient. Undermining allows the skin edges to evert more easily and reduces tension on the sutures.^{3,6,7,10,14}

Choice of Suture and Needle

The qualities most important in suture are flexibility, strength, secure knotting, and infection potential.¹⁹ The two major categories of suture are absorbable and nonabsorbable. Absorbable suture is made from synthetic polymer or mammalian-derived collagen (gut). Common synthetic absorbables include polyglactic acid (Vicryl), polyglycolic acid (Dexon), and polydioxanone (PDS). Absorbable sutures are usually placed deep in larger wounds to reduce skin tension for the final closure.

Nonabsorbable sutures are used for skin closure and permanent internal placement, such as cardiac valves. Common nonabsorbable sutures include silk, nylon (Ethilon), and polypropylene (Prolene). Silk and nylon suture can be braided, adding strength and improving knotting potential, but are more likely to harbor infection. Polypropylene and unbraided nylon are monofilaments, and are less likely to harbor infection, but knots are less secure and more difficult to tie.^{9,19} Silk and gut, as natural materials, cause considerable tissue inflammation and have been largely replaced by synthetic suture material.^{9,19}

Suture size is indicated by the code 0; the more 0's, the smaller the suture diameter. Generally, 4-0 or 5-0 monofilament nylon can be used on the body and scalp, and 6-0 nylon on the face.^{6,10} Polypropylene can be considered for the scalp, primarily because it is blue and easy to see. Suture needles are made of noncorrosive stainless steel, especially forged to achieve maximum strength and ductility, the ability to bend under pressure without breaking.¹⁹ Suture needles have an eye, body, and point. Most needles have a swaged eye where the metal of the needle is molded around the end of the suture. This part of the needle is soft and likely to bend or break if mishandled. The body of the needle is designed for great strength and secure grasping; it is usually flattened with slight convex

Table 3. Special Studies for Skin Biopsies

Study	Fixative or Solution
Histopathology	10% Buffered formalin
Direct immunofluorescence (blistering diseases and lupus erythematosus)	Michel's solution
Electron microscopy	Electron microscopy fixative; glutaraldehyde
Bacterial or fungal cultures	Sterile container with nonbacteriostatic saline
Viral cultures	Viral transport media

or concave sides to avoid rotation in the holder while suturing. Three types of needle points are common: cutting, tapered, and blunt. Cutting needles allow for easy passage through tough tissue and are ideal for skin. A code has been developed to denote the purpose of the needle. For skin (FS) and cutting needles (CE) are used on thick skin, whereas plastic (P), plastic skin (PS), and premium (PRE) are used for cosmetic closures. The size of the needle is ranked by a number, with higher numbers identifying larger needles. Needle curvature is measured in terms of proportion of a circle, with one-quarter, one-half, and three-eighths curves available. Most biopsy wounds in thick skin can be closed using an FS-3 or CE-3 needle, and P-3 can be used for the face, all with a three-eighths curvature. C-17 needles were developed specifically to close punch biopsies, and are less expensive than FS, CE, P, or PRE needles. When in doubt, consult the needle package, which is illustrated with a full-size diagram of the enclosed needle.

When wound closing seems more difficult than expected, reassess the appropriateness of the instruments. Needle selection is often a prime factor in the ease of suturing and final cosmetic result.¹⁴ A larger needle may decrease the difficulty of the job.

Closing

Primary closure of a punch wound can be accomplished with one or two, single-layer, interrupted sutures. Excisions can be closed in one or two layers, with two-layer closures giving better cosmetic results in the larger wounds.

The most common closure technique is a simple, interrupted suture.¹⁰ To begin, grasp the needle with the needle-holder at midpoint or about one third the distance from the eye. This will provide maximum driving force and diminish the likelihood of bending or breaking the needle. A palm grip is recommended to increase the driving force of the needle through the skin. Place the handle of the holder in the palm, wrap the thumb and fingers around the handles, and extend the index finger down over the tip of the holder near the needle. The needle point is placed perpendicular to the skin surface about 2 mm away from the wound edge, and is driven down, then up into the center of the wound. A second insertion begins in the center of the wound, and exits the skin on the opposite side, 2 mm from the wound edge, perpendicular to the surface. If done properly, the suture will make a flask-shaped loop; the loop beneath the skin surface is farther apart than the entry and exit points on the surface. For small excisional wounds, and for most punch wounds, a needle exit in the middle of the wound is not necessary, but depends on the size of the needle and the ease that the wound edges can be approximated and everted.

The instrument tie is fast and efficient. To begin, hold the needle holder parallel to the long axis of the wound with the free end and needle end of the suture on either side of the holder. Wrap the needle end of the suture twice

around the holder, then grasp the free end of the suture with the holder and pull through, tightening the knot. At this point the needle end and free end of the suture should have switched sides relative to the beginning. The process is repeated as needed, reversing the position of the free end and needle end of the suture with each knot. "Approximate, don't strangulate" acknowledges the importance of proper tension on the suture. Excessive tension can be recognized by blanching of the wound edges, and may indicate the need for subcutaneous sutures or simply less tension on each suture.

Placement of sutures for elliptical excisions can be facilitated by following the "rule of halves."¹⁰ The wound is divided in half by the initial suture placement, and each half is itself halved by the subsequent placement of sutures. Similar halving continues until all wound edges are approximated. Starting the initial suture at an apex rather than the middle runs the risk of "dog ears" at the opposite apex owing to the creation of uneven wound edges.

In large wounds, the skin tension can be reduced by placing a temporary initial suture at the midpoint of the wound, but farther from the edge than usual. At a later time, this suture can be removed as the wound is approximated with the permanent sutures.

Diamond and hexagonal excisions are easily closed by placing the initial sutures at the two opposing points of the diamond or four opposing points of the hexagon, then adding other sutures as necessary to completely approximate the wound (Fig. 3). The straight lines of the diamond and hexagon provide better approximation of edges for the beginner than do the curved surfaces of the ellipse.⁴

AFTER BIOPSY

Wound Dressing

Wounds heal faster when moist, and under an occlusive or semioclusive dressing.¹⁷ All biopsy wounds can be dressed with a thin film of an antibiotic ointment (bacitracin, polysprine, mupirocin) or plain petrolatum to prevent crust formation, then covered with a Band-Aid or other nonadherent covering, and topped with a gauze dressing and tape.^{10,17} The dressing should be removed in 12 to 24 hours and thereafter cleaned with soap and water twice daily. After cleaning, the wound should be covered with an antibiotic ointment or petrolatum. Wounds healing by secondary intention need to be redressed after each cleaning until healed over, or for at least 5 days, whereas this is optional for sutured wounds. For sutured wounds, showering is permitted after 24 hours, but use of hot tubs is prohibited until the sutures are removed.²⁰

Suture Removal

There is a balance between the tendency for wound dehiscence or stretching if the sutures are removed too early, and the production of suture marks if they remain

too long.^{9,19} Generally, sutures on the face can be removed in 3 to 5 days, followed by the application of semipermeable adhesive strips to reduce wound tension.^{10,17,19} Sutures on the chest, abdomen, arms, and scalp can be removed in 7 to 10 days, and those on the back and legs in 12 to 20 days.^{10,17,19} Physicians should remove sutures from their patients to learn first-hand the results of their suturing technique and wound healing. Any crust should be washed away with wet gauze, then the suture is gently lifted near the knot, and one side cut close to the skin surface. The suture is removed by pulling across the wound surface; pulling away from the wound puts tension on the wound and may cause dehiscence.¹⁰

Complications

The major complications include bleeding, infection, and allergic reactions. Most bleeding can be controlled with simple pressure on the wound.⁴ If this is not successful after 5 minutes, a single suture may be sufficient. If bleeding remains uncontrolled, remove the suture, find and tie off the bleeding vessel, then resuture.

Bleeding and hematoma formation can be minimized by using a pressure dressing directly over the wound.¹⁷ Tape a folded 4 × 4 gauze pad tightly over the wound, or secure it with an elastic bandage or self-adhering wrap. An ice pack applied for 3 to 5 minutes several times during the first 24 hours will also help decrease bleeding, hematoma formation, pain, and edema.¹⁷ Infection, though relatively uncommon, is usually the result of *Staphylococcus*, *Streptococcus*, or *Candida*.²¹ If the wound is frankly purulent, or has an associated cellulitis, culture the discharge and begin oral antibiotics. Infected wounds in the hands, feet, and intertriginous areas are often infected with *Candida* and can respond to topical antifungal ointments.²¹ Occasionally patients will develop reactions to topical antibiotics.²² The wound will be red, itchy, and may have vesicles. If this occurs, stop the antibiotic and apply a topical corticosteroid ointment. Tape reactions are usually irritant rather than allergic and improve simply by not taping, or sometimes by changing the direction of the tape on the skin.²³

Documentation

All procedures must be documented in the medical record. Minimal content includes location and nature of the lesion, indications for procedure, what was done, and how it was performed, specimen disposition, and instructions to and follow-up plans for the patient. The appendices contain examples of patient instructions and procedure notes.

SUMMARY

Skin biopsy is an essential technique in the management of skin diseases, and although it can enhance der-

matologic care rendered by internists, it cannot replace clinical knowledge. Shave biopsy requires the least experience and time, but its use is limited to superficial lesions and should not be used for pigmented lesions. Punch biopsy is the primary diagnostic procedure in dermatology, is simple to perform, has few complications, and small biopsies can heal without suturing. Although closing with sutures improves the cosmetic result, it requires more expertise and time. Excisions are ideal for removing large or deep lesions, provide abundant tissue for multiple studies, and can be curative for a number of conditions including cancer. However, excisions require the greatest amount of expertise, time, and office resources, and are associated with more complications, including bleeding and infection. Because of its complexity and complication potential, clinical training is highly recommended prior to attempting an excisional biopsy. For the interested novice, a number of learning resources and workshops are available to enhance knowledge, proficiency, and confidence.^{10,12,14,24-26}

REFERENCES

1. Wigton RS, Blank LL, Nicholas JA, Tape TG. Procedural skills training in internal medicine residencies. A survey of program directors. *Ann Intern Med*. 1989;111:932-8.
2. Fitzpatrick TB, Bernhard JD. The structure of skin lesions and fundamental of diagnosis. In: Fitzpatrick TB, Eisen AZ, Wolff K, Freedburg IM, Austen KF, eds. *Dermatology in General Medicine*. 3rd ed. New York, NY: McGraw-Hill; 1987:47.
3. Pariser RJ. Skin biopsy: lesion selection and optimal technique. *Mod Med*. 1989;57:82-90.
4. Pinkus H. Skin biopsy: a field of interaction between clinician and pathologist. *Cutis*. 1977;20:609-14.
5. Arca MJ, Bierman JS, Johnson TM, Chang AE. Biopsy techniques for skin, soft-tissue, and bone neoplasms. *Surg Oncol Clin North Am*. 1995;4:157-74.
6. Bart RS, Kopf AW. Techniques of biopsy of cutaneous neoplasms. *J Dermatol Surg Oncol*. 1979;5:979-87.
7. Peters MS, Winkelman RK. The biopsy. *Dermatol Clin*. 1984;2:209-17.
8. Krull EA, Babel DE. Diagnostic procedures of the skin, part two: skin biopsy and other tests. *J Fam Pract*. 1976;3:427-31.
9. Harrison PV. A guide to skin biopsies and excisions. *Clin Exp Dermatol*. 1980;5:235-43.
10. Dinehart SM, Hanke CW, Geronemus RG. *Dermatologic Surgery for Medical Students*. Schaumburg: Association of Academic Dermatologic Surgeons; 1993.
11. Cohen MS, Do JT, Tahery DP, Moy RL. Efficacy of double gloving as a protection against blood exposure in dermatologic surgery. *J Dermatol Surg Oncol*. 1992;18:873-4.
12. Snell G. Skin biopsy. In: Pfenninger JL, Fowler GC, eds. *Procedures for Primary Care Physicians*. St. Louis, Mo: Mosby-Year Book; 1994:20-6.
13. Ritchie JM, Greene NM. Local anesthetics. In: Gilman AG, Rall TW, Nies AS, Taylor P, eds. *The Pharmacological Basis of Therapeutics*. 8th ed. New York, NY: Pergamon Press; 1990:311-31.
14. Epperson WJ. Laceration and incision repair. In: Pfenninger JL, Fowler GC, eds. *Procedures for Primary Care Physicians*. St. Louis, Mo: Mosby-Year Book; 1994:7-11.
15. Grekin RC. Simple dermatological surgical procedures. *Res Staff Phys*. 1989;35:61-7.
16. Todd P, Garioch JJ, Humphreys S, Seywright M, Thompson J, du

Vivier AWP. Evaluation of the 2-mm punch biopsy in dermatological diagnosis. *Clin Exp Dermatol*. 1996;21:11-3.

17. Telfer NR, Moy RL. Wound care after office procedures. *J Dermatol Surg Oncol*. 1993;19:722-31.
18. Stengel FM. Indications and technique of biopsy for diseases of the scalp. *J Dermatol Surg Oncol*. 1978;4:170-1.
19. Moy RL, Waldman B, Hein DW. A review of sutures and suturing technique. *J Dermatol Surg Oncol*. 1992;18:785-95.
20. Noe JM, Keller M. Can stitches get wet? *Plast Reconstr Surg*. 1988;81:82-4.
21. Bennett RG. Microbiological considerations in cutaneous surgery. In: Bennett RG, ed. *Fundamentals of Cutaneous Surgery*. St. Louis, Mo: CV Mosby Company; 1988:136-78.
22. Gette MT, Marks JG, Maloney ME. Frequency of postoperative allergic contact dermatitis to topical antibiotics. *Arch Dermatol*. 1992;128:365-7.
23. Grolnick M. Factors involved in the production of adhesive plaster irritation. *Am J Surg*. 1940;50:63-78.
24. Mathes BM. Common Office Skin Biopsy Techniques [videocassette]. Gainesville, Fla: University of Florida, Department of Dermatology; 1996.
25. Stawiski M. Skin Biopsy Techniques [videocassette]. Ann Arbor, Mich: University of Michigan, Department of Dermatology; 1979.
26. Meek TJ. Elliptical Excision and Suture of Cutaneous Lesion. [videocassette]. Baton Rouge, La: Louisiana State University, Department of Dermatology; 1978.

APPENDIX A

Sample Patient Instructions for Wound Care

Open Wounds

The biopsy done today will heal from the bottom up and sides inward. Remove the Band-Aid in 12 to 24 hours, and clean it twice per day with soap and water. Apply a thin coat of antibiotic ointment such as bacitracin or polysporin, unless otherwise instructed, then cover with a Band-Aid. This type of wound heals faster when covered. If you have a lot of itching, redness, drainage of pus, swelling, or pain, call the office. Tylenol or ice packs may be used for pain control.

Sutured Wounds

The biopsy done today has stitches that will need to be removed in __ days. Beginning tomorrow, remove the dressing, wash twice daily with soap and water, then apply a thin film of antibiotic ointment such as Bacitracin or Polysporin. Band-Aids are optional. Call the office if you experience significant redness, pain, itching, swelling, or drainage of pus. If you are unable to keep your appointment for suture removal, call the office. Tylenol or ice packs can be used for pain control.

APPENDIX B

Sample Procedure Notes

Shave Biopsy

The possible diagnosis of basal cell carcinoma and need for biopsy confirmation was discussed with the patient, and consent for a shave biopsy of the left ear was obtained. The skin was prepped with alcohol; local anesthesia was obtained with 1% lidocaine with epinephrine and NaHCO₃. A shave biopsy into the dermis was performed with a razor and hemostasis was achieved with AlCl₃. The biopsy specimens were submitted to pathology in formalin. A Band-Aid dressing was applied. Wound instructions were given. The patient will return in 2 weeks for a wound check, and review of pathology results.

Punch Biopsy

A possible diagnosis of lupus was discussed with the patient and the need for two biopsies reviewed. Consent for the procedure was obtained. The skin of the right upper, inner, and outer arm was prepped with Hibistat and alcohol, and local anesthesia was obtained with 1% lido-caine with epinephrine and NaHCO₃. Punches of 3 mm were obtained from the outer and inner right arm to the depth of the subcutaneous fat, and each was closed with a 4-0 nylon suture. The specimen from the outer arm was placed in formalin and from the inner arm into Michel's solution and submitted to pathology. Band-Aid dressings were applied. Wound care instructions were given. The patient will return in 10 days for suture removal and review of pathology results.

Elliptical Excision

Description: atypical nevus 8 × 4 cm left upper back. The possible diagnosis, procedure, need for biopsy, potential complications, side effects and scarring were discussed with the patient, and consent for the procedure was obtained. The patient was placed in the prone position, local anesthesia was achieved using 1% lidocaine with epinephrine and NaHCO₃, and the skin was prepped and draped in the usual sterile fashion (with povidone-iodine [Betadine] and alcohol). The lesion and a 2-mm clear margin was excised in an ellipse to the depth of the subcutaneous tissue. Wound edges were undermined bluntly, three 4-0 Vicryl inverted mattress sutures were placed in the dermis. The wound was closed with five 4-0 nylon sutures. A pressure dressing was applied. Wound care instructions were given. The specimen was sent to pathology in formalin. Final specimen length 2.5 cm. The patient tolerated the procedure well. She will return in 14 days for suture removal and review of pathology results.