

**Wayne State University**

**Department of Surgery**

**Wound Closure II–Intermediate Module**

Guillermina Nava, M.D.  
Division of Plastic Surgery

## Wound Closure II – Intermediate Module

### 1) Objectives

- a) Cognitive
  - i) By the end of this laboratory session participants should.....
    - (1) Understand how to approach the excision of a lesion with special consideration to body region & margins.
    - (2) Understand how to approach closure of a defect with special consideration to body region.
    - (3) Understand the advantages and disadvantages of undermining surrounding tissue to assist with wound closure.
    - (4) Understand how to approach closure of a wound that has a dog ear.
    - (5) Understand the principles of closure of a traumatic laceration
- b) Technical
  - i) By the end of this laboratory session participants should be able to.....
    - (1) Perform excision of a skin lesion considering body region and margins.
    - (2) Perform closure of a wound considering body region.
    - (3) Perform wound closure with assistance of undermining.
    - (4) Perform wound closure with excision of dog ear.
    - (5) Perform closure of a traumatic laceration.

### 2) Assumptions of pre-training surgical skills and knowledge

The student should review each of the manuals, CD's and videos listed below in Sections 3 or 8 which describe in detail the various types of instruments, sutures, wound closure techniques and anatomical considerations necessary to complete this module.

### 3) Preparation (resources for students, websites, books, articles)

a)

### 4) Anatomical Consideration

In this module, it is expected that the student will have a thorough knowledge of the multiple layers of the body tissue and their relative characteristics (ie. depth, consistency, length, etc.) depending on the region of the body. The student should understand and be able to describe the relationship between specific tissue types and the appropriate suture with needle and wound closure technique for each tissue layer. Advantages and disadvantages of each choice should be well understood.

The student should understand how to approach excisional biopsy of a skin lesion based on the presumed pathology in regards to the appropriate margins as well as the orientation of the planned excision. The student should have an understanding of the appropriate orientation of an elliptical skin excision based on body location and relaxed skin tension lines. A systematic approach to closure of the defects left after excision should also be mastered in regards to utilization of undermining to relieve tension and the possible need for dog ear excision.

The student should be able to assess and plan a systematic approach to a traumatic laceration for primary closure.

## 5) Description of Laboratory Module

The faculty instructor will provide a brief overview of the cognitive and technical objectives listed above. The instructor then carefully demonstrates the technical objectives for the module.

Excision of “skin-lesions” from different areas of the body will be attempted careful to take into account the orientation of the ellipse along Langerhan’s lines depending on the region being excised, understanding proper orientation for excision of a lesion on the extremity and excising the lesion perpendicularly along the skin edge through the deeper layers in a consistent fashion to obtain a proper specimen. It is also important to take into consideration the planned margins for excisional biopsy depending on the presumed diagnosis of the lesion in question.

The goal of wound closure is to produce a carefully re-approximated wound with atraumatic technique. This often requires closure in multiple layers. Skills learned in Wound Closure I will be utilized for closure of the skin layer. This is accomplished with accurate placement of needle through the skin in a perpendicular fashion and placement of deep dermal sutures to assist with tension reduction, wound eversion and closure of the dead space in the depth of the wound. Use of undermining to relieve tension will also be attempted to assist with closure.

*Buried sutures: Deep absorbable sutures:* Buried sutures are important for obtaining wound eversion, providing prolonged wound tensile strength and closing dead space. The most common suture materials used in this technique are Vicryl, PDS and Maxon. The knot is buried downward. Buried sutures need not be placed as close together as external sutures. Often only 1 to 3 deep sutures are needed to close the dead space and bring the wound margins together. Multiple deep layers may need to be reapproximated (ie. fascial, dermal edges).

*Elliptical Excision:* The elliptical excision is used to excise a lesion or subcutaneous mass that is too large for a punch biopsy. As with the punch biopsy, the elliptical excision removes the full thickness of the skin and is sutured for closure. Important factors to consider when planning an excision include the following; avoiding vital structures, placement of incision lines, size of surgical margin, whether the closure can be accomplished with a side-to-side closure, whether anatomic distortion will occur. To avoid vital structures it is critical to understand the anatomy of the region where the lesion is being excised. Placement of the incision line is often determined by considering wrinkle lines and relaxed skin tension lines (RSTL). RSTL’s are

the parallel skin lines that are seen when the skin is pinched together. Planning of an ellipse in the face must be done carefully to avoid distortion of surrounding structures/landmarks (eyebrow, eyelid, lip, etc.)

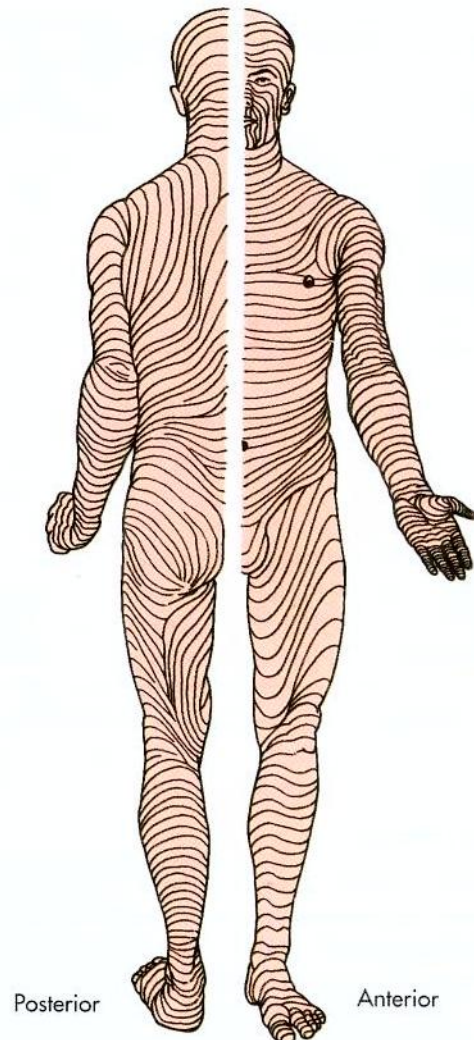


FIG 10-3  
Relaxed skin tension lines on the body. (From Fewkes JL, Cheney ML, Pollack SV: *Illustrated atlas of cutaneous surgery*, Philadelphia, 1992, Lippincott-Gower.)

Surgical margins are determined by the pathology of the lesion being excised. The surgical margins will be at least 3-5 mm for BCC, 4-6 mm for SCC, and 1-2 cm for melanoma. When the suspicion for malignancy is low, a shave biopsy or an excision with smaller margins of 1 to 2 mm is usually adequate. Unless there is high suspicion for melanoma in which case a punch biopsy would yield a better specimen for evaluation of depth of the lesion. The standard ellipse is drawn so that the length of the ellipse is at least three times the width of the ellipse. The ends of the ellipse should be approximately 30-degree angles so that potential dog ears are minimized.

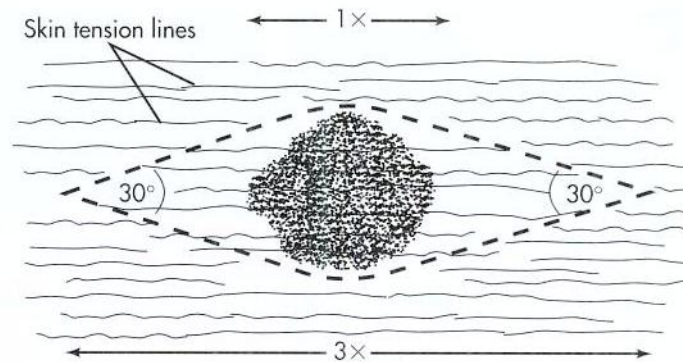


FIG 10-4  
3:1 ratio for marking an elliptical incision.

*Closure of the defect:* It is usually necessary to close a full-thickness defect in multiple layers. If side-to-side closure is possible, pinching the skin can often determine if it is possible. Undermining of surrounding tissue might be necessary to obtain primary closure and relieve tension. If there is doubt whether an ellipse can be closed or if there is potential for anatomic distortion, it is possible that a flap or graft might be necessary. These approaches will not be covered during this module.

*Dog-ears* are created when wounds of different margin lengths are closed. This usually results after excision of an asymmetric ellipse. Elevation or creation of advancement flaps can also produce dog-ears. Proper planning of incisions can avoid creation of dog-ears; however, at times these cannot be avoided. Addressing the dog-ear can be done with redistribution of tension across the wound when placing sutures or by extension of the incision to eliminate the dog-ear.

*Traumatic skin laceration:* Traumatic skin lacerations of various regions of the body are frequently encountered in the emergency department. They occur most frequently in young men, typically on the face, scalp and hands. Most are caused by blunt injury that produce shear forces with others caused by sharp objects such as metal, glass and wood. Only a small percentage of wounds are caused by bites. The ultimate goals of wound management are to avoid infection and achieve a functional and cosmetically acceptable scar. To achieve these goals, one must identify patient and environmental factors that could increase the likelihood of a poor outcome, appropriately prepare and close the wound in a meticulous and timely fashion.

## 6) Module Instruction, Narrative Description, Skill Description and Training Method.

Each student will use a pig belly to perform the technical skills for this module. Students will excise several “lesions” of varying sizes and directions on the pig belly, followed by layered closure with use of undermining, and excision of dog ear when necessary. Students will use the necessary instruments and sutures to perform each task for this module.

*Planning and Designing Excision:* There are several important factors to consider when planning an excision of a skin lesion. These include; avoiding vital structures, proper placement/orientation of incision lines, planning the size of the surgical margin, understanding whether the closure can be accomplished with a side-to-side closure, and understanding whether anatomic distortion will occur. Avoidance of vital structures is critical in planning and for proper execution of excision to limit distortion or deformity. Utilizing the wrinkle lines and RSTLs for planning can assist in minimizing deformity. Planning of an ellipse in the face must be done carefully to avoid distortion of surrounding structures/landmarks (eyebrow, eyelid, lip, etc.)

*Surgical margins* are determined by the pathology of the lesion being excised. In general, the surgical margins will be at least 3-5 mm for BCC, 4-6 mm for SCC, and 1-2 cm for melanoma. If the pathology of the lesion is unclear, a 5mm margin can be planned for the initial excision. If final pathology reveals melanoma, a secondary wide local excision will be planned to obtain the proper margin based on the depth of the lesion. When the suspicion for malignancy is low, a shave biopsy or an excision with smaller margins of 1 to 2 mm is usually adequate. If there is high suspicion for melanoma a punch biopsy would yield a more appropriate specimen for evaluation of the depth of the lesion. If melanoma is suspected, a shave biopsy should never be utilized as a biopsy method. An ellipse should be designed such that the length is at least three times the width with the ends of the ellipse at approximately 30-degree angles. This will help to minimize the potential for a dog ear.

*Incision:* No. 15 blade is used to perform the incision. Scalpel is held like a pencil. The tip of the blade is used to incise the corner while the belly of the blade is used to incise the remaining skin edges. The incision should be made in a perpendicular fashion. Carry the incision down to the subcutaneous tissue. Care should be taken to avoid beveling the incision as it carries into deeper tissues either medially or laterally from the planned incision line.

*Undermining:* After excision of the planned skin lesion, Undermining can be utilized, if necessary, to relax any tension that might inhibit primary closure. Blunt tenotomy scissors are used to undermine the edges of the incision. This allows mobilization of the tissue to advance the edges to close

the defect. The edges of the defect can be elevated with skin hooks or an adson's forceps. Only the dermis should be grasped with the forceps so as to avoid crushing the epidermis. Most areas of the body are undermined within the subcutaneous fat. The scalp should be undermined in a subgaleal plane; the face in the high fat, the nose in the deeper fascia or connective tissue plane, while the trunk and extremities are undermined in the deep subcutaneous fat above the muscle. Undermining should allow the skin edges to come together without much tension and allow eversion of the wound edges with suturing.

After excision of a skin lesion, approach to closure of the resulting defect in multiple layers will be approached in a systematic fashion taking into consideration the area of the body in question, selecting the proper suture and addressing the development of any dog-ears as a result of the excision.

*Closure of the lesion:* Determining if side-to-side closure is possible, is simply done by pinching the skin. If there is too much tension, undermining of surrounding tissue might be necessary to obtain primary closure. The defect should be closed in multiple layers, fascial, muscle, deep dermal and skin depending on depth of defect and involved layers. Buried sutures should be used for the deeper layers with absorbable suture of appropriate size (usually 3-0 to 4-0 vicryl or monocryl). This can then be followed by closure of the epidermal layer with simple interrupted sutures, a running baseball stitch or a subcuticular closure.

*Dog-ears* are created when wounds of different margin lengths are closed. This usually results after excision of an asymmetric ellipse. Elevation or creation of advancement flaps can also produce dog-ears. Proper planning of incisions can avoid creation of dog-ears; however, at times these cannot be avoided. Addressing the dog-ear can be done with redistribution of tension across the wound when placing sutures or by extension of the incision to eliminate the dog-ear. (Figure of dog-ear excision)

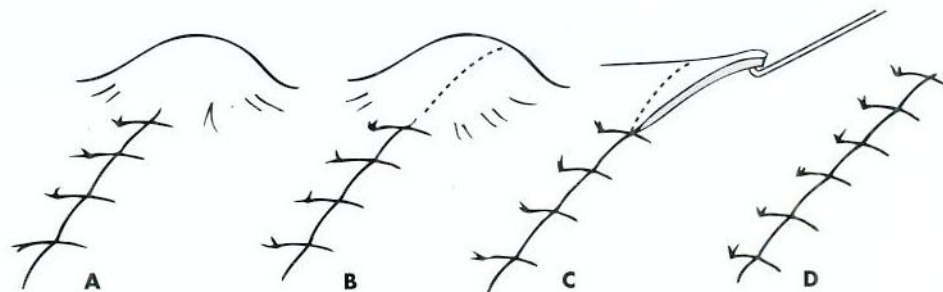


FIG 10-8  
Dog ear repair. A, Bulging dog ear. B, The tissue is cut along the dotted line with a No. 15 blade. C, The extra tissue is brought across with a skin hook, and a cut is made along the new dotted line. D, Two new sutures are placed, and the dog ear is flattened.

Repair of the elevated cone of tissue at either end of an elliptical excision is easily accomplished by extending the length of the excision. This is usually accomplished by extending the excision through the center of the elevated cone tissue. This results in two overhanging edges of tissue that need to be trimmed to flatten out the elevated cone of tissue. This trimming is done with a No. 15 blade to neatly trim the tissue to the very end of the excision.

*Traumatic Skin Laceration:*

Wound evaluation/preparation: To properly assess a wound, it must be cleansed and irrigated thoroughly. Often local anesthetic needs to be applied prior to manipulation of the tissues to prevent undue pain to the patient. However, it is critical to do a thorough neurovascular and functional exam prior to administration of anesthesia to properly evaluate any concomitant injury of nerve or other vital structure. After local is administered, the wound should be irrigated with a 30- or 60- ml syringe and splash guard to provide the adequate pressure for mechanical debridement. This allows removal of any foreign debris, easier assessment for the presence of a foreign body (glass, asphalt, etc.) and evaluation for bleeding. Bleeding should then be controlled. Proper cleaning of the wound and control of bleeding allows for better assessment of the laceration, viability of surrounding tissue, as well as the layers involved in the laceration. Debridement or cleansing of any non-viable tissue or foreign debris should be done prior to closure.

Assessing viability of the involved tissue can be challenging. Excess debridement is not advised unless its removal would provide ease of closure in a more cosmetic manner.

Closure of the wound in multiple layers should be done with careful re-approximation of the involved layers (fascial, muscle, dermis, skin). This allows closure of any dead space and re-alignment of underlying muscle and fascia. Suture for the deeper layers should absorbable and of appropriate size.

**7) Equipment Requirements and Materials Needed**

- a) Pig belly skin
- b) 15, blades
- c) Adson forceps – single-tooth, with teeth
- d) Marking pens
- e) Needle driver
- f) Hemostats
- g) Suture – 3-0, 4-0 vicryl
- h) Suture – 3-0, 4-0, 5-0, 6-0 prolene, nylon
- i) Skin hooks, two prong
- j) Blunt tipped tenotomy scissors
- k) Suture scissors



**8) References**

Usatine RP, Moy RL. (1998) *Skin Surgery A Practical Guide* (1<sup>st</sup> edition). Mosby.  
(see accompanying PDF file)

**9) Time Length**

**10) Appendix**