

Soft Tissue Handling and Dissection

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Problem Identification and Needs Assessment

Identification of targeted learners

Orthopedic surgery PGY-1 Residents

Identification of need or problem for targeted learners

To educate the PGY-1 residents on proper techniques of surgical dissection, including incision, dissection, identification of surgical planes and approaches, as well as important anatomic structures.

Surgical dissection requires understanding of proper instrument use, including scalpel, cautery, forceps, and scissors. Residents must gain expertise in both sharp and blunt dissection, and be able to identify tissue structures, such as vessels, nerves, muscle/fascia, joints and bone.

This module will also enable the resident to further their training in soft tissue suturing and closure, which is material contained in another module.

Current educational approach to address need or problem

Currently, residents are educated in soft tissue handling techniques in the operating room, during anatomical prosection, and in lecture. This module will help organize and formalize this aspect of their education.

Ideal educational approach to address need or problem

Residents should complete this module utilizing dedicated space, the necessary equipment, and faculty supervision in an un-hurried environment.

Goals and Objectives

Specific educational goals

By the end of the module learners should:

- Demonstrate use surgical instruments, including scalpels, scissors, forceps, retractors, and clamps.
- Demonstrate how to plan a surgical approach, utilizing bony landmarks, with attention to important structures, such as neurovascular anatomy.
- Dissect soft tissue using appropriate techniques, which allows identification of surgical planes.
- Demonstrate sharp and blunt dissection, protection and ligation of vascular anatomy, and identification of different tissue types.
- Demonstrate wound closure in a layered fashion, using a variety of methods including interrupted and running sutures.

Syllabus Development

Assumptions

It is assumed that residents will have some knowledge and experience of surgical instruments, anatomy, and principles of surgical approaches.

It is also assumed that residents will have completed the suturing module prior to this module so that they have gained experience in closure techniques prior to participating in this educational module.

Suggested reading

- Hoppenfeld S, deBoer P, Buckley R. Surgical Exposure in Orthopaedics. J. B. Lippincott Co., 4th Edition, Philadelphia, 2009, 148-182.

Description of laboratory module

The module will begin with a 15 minute review of surgical instruments, including scalpels, scissors, clamps, and forceps, as well as retractors. This will include the various types of each instrument (e.g. different types of scalpels and blades) and the proper handling techniques to be used with these instruments.

The resident may then be asked to perform a surgical approach of a forelimb. Basic handling should be practiced on an animal model.

For more in-depth and advanced dissection, human fresh frozen forearm can be utilized. Residents will mark their approach, sharply and bluntly dissect tissue planes, identify surgical landmarks, important structures, and then close the wound in a layered fashion. The resident should review the pertinent anatomy prior to this module. Residents will work in teams with faculty supervision, so that they can assist each other with retraction and exposure.

Description of techniques and procedures

Part 1: Instrumentation and their handling

Scalpels

10 blade: This scalpel has a long broad cutting surface. The belly of the blade is the proper cutting surface. It is often utilized in skin incisions, and in the dissection of planes when cutting in a straight line. This blade is best held like a violin bow to maintain optimal control.

15 blade: The blade of this scalpel is narrower and smaller, and the curved tip is the primary cutting surface. It is utilized when shorter or angled incisions are necessary, or in deep dissection with limited space. This blade is best held like a pencil to have optimal control.

11 blade: This blade has an angled, pointed tip. It is primarily used to make a stab type incision, such as in arthroscopy. It is also best handled similar to a pencil, utilizing a gentle sawing motion to make an extended (greater than the width of the blade) incision.

Scissors

Metzenbaum/tenotomy scissors: These scissors are primarily used for both blunt and sharp dissection. Principles include spreading the tips for blunt dissection and using the tips for sharp dissection.

Mayo scissors: These scissors have a broader blade and wider spread. They may be curved or straight. Principles of use are the same as Metzenbaum scissors.

Forceps

In general, forceps should be held like a pencil or fork to have optimal grasp control.

Adson forceps: Small fine forceps used for handling skin or fragile structures. May have teeth (used for grasping skin for example) or without (used for grasping fragile structures).

DeBakey forceps: Longer but still fine forceps without teeth. Used for handling structures such as vessels or nerves which require fine delicate touch.

Forceps with teeth: Can come long or short, and is the primary forceps used when handling soft tissue such as fascia, muscle, periosteum, etc. These forceps provide the maximal control with grip of tissue for tension, mobility, etc.

Retractors

Retractors come in wide variety of shapes and sizes. The resident should be exposed to the various types during this module, including skin rakes, blunt retractors such as an Army-Navy, self-retaining retractors (both sharp and blunt), and deep retractors, such as Hohmann's.

Part 2: Soft tissue handling in the porcine model

Holding the instruments

As mentioned above, the 10 blade is usually best held like a violin bow. This is used to incise broad flat surfaces.

Incision

Using your dominant hand, draw the knife along the skin surface, choosing either the dorsal or ventral side. The non-dominant hand can be used to help spread the skin.

Dissection

On skin, toothed forceps should be used, held in the non-dominant hand like a pencil. The tips of the scissors are used to tease tissue by spreading, so that the structures are clearly seen. While there are different surgical preferences, the scissors are generally held in the dominant hand, the thumb and ring fingers in the rings, and the tips pointing down. This provides a more ergonomic position

for dissection, such that when turning the scissors on its side to cut, the scissor tips are naturally pointing in the correct cutting direction. Fully pronate to spread, supinate to neutral to cut. Then, if you need to dissect with your tips up, supinate fully. Start from known and dissect toward unknown in a systematic fashion. One pitfall is to dissect and spread haphazardly without making purposeful progress. When dissecting around neurovascular structures, nerves are generally spread in line; arteries are spread perpendicular, so that small side branches are not ruptured.

Retraction

Weitlaner retractors may be used to hold tissue open. When placing the Weitlaner, care must be taken to avoid impinging on important structures, such as nerves and vessels. There are sharp and blunt Weitlaners. The sharp teeth grip tissue better, but the blunt ones are safer around vital structures.

Completion of this exercise

The resident will incise skin, dissect the subcutaneous tissue, elevate skin with a knife, and place appropriate retractors. Scissors are used for careful dissection of the fascia. The initial exercise can start off dorsally, where the resident will dissect out the extensor tendons. Then, the resident should continue on the volar side. Here, carefully dissect out each of the flexor muscle bellies without transecting any vital structures, keeping the muscle fascia intact. The resident will finish off by closing the wounds, practicing various techniques described in the suture and knot tying module.

Part 3: Surgical approach of the forearm

The resident will perform an approach to the cadaver forearm, either anterior or posterior. The approach is detailed in the aforementioned suggested reading of Hopenfeld. The anterior approach will be described below:

Approach

The resident should mark the incision to be utilized, from the radial tuberosity proximally to the radial styloid distally, with the forearm positioned in supination.

Incision

The incision is made with a 10-blade through the subcutaneous tissue down to the superficial fascia.

Dissection

Once fascia is exposed retractors are placed and skin flaps are raised to increase exposure.

The fascia is incised in line with the incision, utilizing either a 10 or 15-blade.

Blunt and sharp dissection is then utilized with scissors, clamps and scalpel to develop the plane proximally between the brachioradialis and pronator teres.

The resident should identify the superficial radial nerve deep to the brachioradialis.

The resident should identify the radial artery beneath the brachioradialis in the middle of the forearm.

The resident should identify the branches from the artery to the brachioradialis and ligate them.

Deep Dissection

The resident should identify the supinator muscle in the proximal forearm, keeping lateral to the biceps tendon. The posterior interosseous nerve should be identified and protected, and the supinator should be released from the radius exposing the proximal radius, using a 15-blade.

The middle of the radius should be then exposed, utilizing slight pronation to help identify the pronator teres and flexor carpi superficialis. Once these muscles are exposed, they are released with either sharp dissection or with the use of elevators.

The distal radius is then exposed with supination of the forearm. The pronator quadratus and flexor pollicis longus is identified and then incised to expose the bone. An elevator can be used to develop the subperiosteal plane.

Retractor Placement

Throughout this module the resident should be asked to use various retractors as needed, including skin rakes during superficial exposure, self-retaining retractors with careful placement, and then deep retractors to expose the radius. Attention to retractor replacement as it relates to protection of important neurovascular structures should be emphasized.

Wound Closure

The resident should then close the wound in a layered fashion. Although not always closed in trauma cases, the resident should close the fascia

in the forearm to practice these techniques. The fascia should be closed with interrupted single and figure of eight stitches. Conversely, the resident could also utilize a running closure of the fascia. Skin is closed with a variety of techniques, again dictated by resident experience and goals of the educational experience.

Once the anterior approach is completed the resident team can trade positions as surgeon and assistant and perform the posterior approach to the forearm, as described in the Hoppenfeld citation above.

Common errors and prevention strategies

Error 1

Improper handling of instruments or using them at improper times. Residents should hold instruments in the appropriate manner, to prevent poor control during surgical dissection. This includes the utilization and placement of retractors.

Error 2

Poor scalpel use and improper skin incision technique. Scything the tissue or jagged cuts (dog ears, etc.) should be avoided. Skin incision should be smooth and longitudinal, perpendicular to the skin surface.

Error 3

Poor scissor technique. Scissors should be used for both blunt and sharp dissection, with the tips doing the work. 5 mm of tissue should be dissected at a time to avoid injuring unseen structures. Scissors should never be plunged and rarely pushed as that can also damage deep structures.

Error 4

Retractor use, position, and technique. The resident should place retractors with care to protect important anatomic structures. The principles of when to use sharp and blunt retractors, or pointed retractors is critical for safe surgical exposure.

Error 5

Wound closure errors. Wounds should be closed with appropriate tension and suture placement. Skin closure should be completed in a symmetric fashion to prevent dog-ear misalignment. Skin hair marks with a pen at the time of surgical

incision can aid in identification of skin landmarks for closure.

Demonstrate expert performance

Video

Recommendations for motor skills practice

Learners should practice:

- Holding the instruments appropriately.
- Techniques of sharp and blunt dissection on another material, such as piece of fruit or animal specimen.
- Suturing techniques and knot tying should be practiced and completed during prior modules to gain proficiency.

Supplies and station setup

Pig's feet and/or fresh frozen human cadaver

Surgical dissection tray which includes:

- Clamps
- Tissue cutting scissors
- Sharp and blunt retractors
- Scalpels

A table with appropriate lighting

Suture and needle drivers for closure, as this can be combined with the suture and knot tying module.

Suggested duration for completion of module

Two hours.

Estimated budget

Cost varies depending on the soft tissue parts used. Pig's feet with attached fore- hind-limbs are approximately \$3.00 each.

Learner Evaluation and Feedback

Methods of performance assessment

The resident at the completion of this module should be able to complete an anterior or posterior approach of the forearm with appropriate tissue handling techniques, without damaging neurovascular structures, identification of tissue planes, deep dissection with exposure of structures to be protected, bone exposure and subsequent layered closure of the approach.

Suggested proficiency benchmarks

Checklist:

The resident appropriately handled all surgical instruments during the exposure.

The resident planned an appropriate approach and marked out the incision adequately.

The resident completed the surgical dissection maintaining principles of blunt and sharp dissection, soft tissue retraction and bone exposure, as previously described.

The resident completed an adequate wound closure, including symmetrical skin closure without dog-ears.

Methods for learner debriefing and feedback

An instructor should be overseeing each station. This could be a senior resident, faculty member or volunteer community surgeon. Real time feedback should be supplied with specific, constructive critiques. After each learner has performed the task, he/she should be asked what went well and what could have been done differently. The instructor should then review

what he/she thought went well and what could have been done differently. Learners who do not demonstrate proficiency should repeat the task until proficiency is demonstrated. Feedback should be provided after each iteration. Three failed attempts to demonstrate proficiency should lead to a one-on-one session at a later date after the learner has had a chance to practice the skills involved in the module in question.

Periodic Curriculum Review, Evaluation, Validation, and Refinement

Review can be performed during residency training as indicated, at the end of PGY-1 and prior to starting PGY-2 training.

Citation: Hutchinson C, Module 4: Tissue Handling, Dissection, Wound Closure. ACS/APDS Surgical Skills Curriculum for Residents, Phase 1. ACS Website. 2006