Virtual Microsurgery Course: Introductory





Course Overview





Learning Objectives

Intro To Microsurgery: History & Application

- Understand concept of microsurgery
- Introduce progression from macro to micro models for anastomosis

Basics Of Suturing: Macro Model

- Describe features of ideal suture placement
- Demonstrate appropriate needle handling, insertion and pull-through in a macro model
- Demonstrate appropriate knot tying in a macro model

Macro Suturing Model

- Basics of suture placement for an end-to-end anastomosis
- Basics of needle insertion & pull through in macro (glove) model
- Basics of knot tying in macro model

Microsurgery Instruments & Suture Introduction

- Demonstrate ability to name instruments and their role
- Understand needle/suture properties and choice of suture
- Demonstrate proper instrument handling
- Faculty demonstration of proper instrument handling





Intro to Microsurgery





History of Microsurgery

1889: first successful end-to-end anastomosis is documented (Jassinowski)
1890s: repair of injured blood vessels in human & animal models
1920: introduction of first operating microscope in Sweden
1960: first successful microsurgical anastomosis using operating microscope
Today: wide application of microsurgical techniques and free tissue transfer
across surgical specialties (plastic surgery, otolaryngology, vascular surgery, etc)





Borrowing from other fields...

Initial use of operating microscopy by otolaryngologists for ear surgery



THE THROMBOPLASTIC ACTION OF CEPHALEN JAY 'MCLEAN From the Physiological Laboratory of the Johns Hopkins University Received for publication, June 15, 1916

In 1912 Howell (1) reported the results of a study of the thromboplastic action of the tissues in which he showed that the active substance is a phosphatid having the general properties of cephalin. The



"Accidental" discovery of heparin by research team at Johns Hopkins Medical School while investigating *pro* coagulants for use during World War I medical efforts





Jewelers' fine-tipped instruments



Q: What Does It Takes to Succeed in **Microsurgery**? MICROSURGEON.ORG

A: Practice!

Harry J. Buncki

Stanford Division of Plastic & Reconstructive Surgery

MICROSURGERY

Kailash Narasimhan, MD John R. Griffin, MD James F. Thornton, MD

SRPS SELECTED READINGS IN PLASTIC SURGERY

Plastic & Reconstructive Surgery

Microsurgery Essentials

Volume 11 - Issue R4

"A first experience has no place in the operating room."

ATLAS OF MICROSURGERY TECHNIQUES AND PRINCIPLES

Microsurgeryeducation.org

Donaghy, "Practice for perfection." J Microsurgery, 1979





Vascular Anatomy





Vessel Anatomy

Blood Vessel Anatomy

| Tunica Externa (adventitia) | Loose, fibrous connective tissue that provides structural support | |
|--------------------------------|---|--|
| Tunica Media | Elastic and muscular tissue regulares internal vessel diameter | |
| Tunica Intima | Endothelium which provides a frictionless channel for blood passage | |









Vessel Injury & Regeneration

creates a full thickness vessel injury

ap harvesting & donor site prep





Vessel Thrombosis

Factors contributing to development of clot at the anastomosis site:

- Vessel injury caused by tissue trauma, hematoma, external compression
- Tension or kinking of vessels
- Presence of microsuture, and injury caused by placement of suture
- Disturbances of coagulation
- Ischemia-reperfusion injury





Antiplatelet & Anticoagulation Agents

| Medication | Mechanism of Action | Use | Dosing |
|--|--|--|---|
| Antiplatelet & Anticoagulating Agents: intervene on clotting cascade to reduce platelet aggregation and clot | | | |
| Heparin | Increases antithrombin-3 activity to inactivate thrombin, which neutralizes activated clotting factors (such as conversion of fibrinogen→fibrin, prothrombin→thrombin, and inactivates factor X), and decreases platelet adhesion through inhibition of fibrin-stabilizing factor | <u>Systemic:</u> anticoagulant in replantation or anastomotic revision <u>Topical:</u> intraluminal vessel irrigation prior to anastomosis, prevent or clear clots | Therapeutic heparin dose as bolus + continuous IV infusion through POD7- 10 Heparinized saline 100 u/mL (dilute in normal saline) in 3 mL syringe with a 26g angiocatheter tip, or anterior chamber cannula (Visitec needle) |





Microsurgery Instruments











Smooth-Tipped Dilating Forceps

Modified Jeweler's forceps with slender, smooth, blunt tip Used to dilate vessels just prior to anastomosis, blunt tip protects vessel from damage

















Straight - used for trimming adventitia or cutting suture **Curved** - used to dissect closely along contour of vessel during preparation







Single or Double Clamps

Flat jaw clamp with gentle spring tension, applied with Rituzzi clamp applier To hold vessel ends at a consistent distance, free of tension, while performing anastomosis









Background

Sheet of material of contrasting color (yellow, blue, green, etc.) *Placed beneath vessels to improve visualization*





cut background along marks





Micro Suture

Suture: nonabsorbable monofilament (prolene, nylon)

Suture Size: 8-0 to 15-0

• Smaller vessels = smaller suture

Needle: 50 to 130 um in diameter

Shape: sharp cutting tip, flat body







Microsurgery Instruments - OR





Micro Clips, Clip Appliers

Used to achieve hemostasis in non-essential vessel branches prior to dividing them during dissection









Bipolar Electrocautery

Used to cauterize small side branches during vessel preparation, while avoiding trauma to perforating vessels and vascular pedicle







Sterile Doppler Ultrasound

Helpful for identifying perforator and recipient vessel, and for assessing patency of anastomosis







Alternative: Anastomotic Coupler







At the start of every practice session and operative case, you should check that you have all the instruments you need, that the instruments are in proper function (tips meet, not magnetized, gentle spring tension without sticking)







Basics of Suturing & Common Technical Errors





"Preconditions of Microsurgical Skill"

- Basic positioning
- Frame of mind
- Hand positioning
- Microscope adjustment
- Instrumentation



Dr. Robert Acland





Microsurgery Posture









"Basic Microsuture Technique"

- Proper needle handling
- Tips and Tricks
- Suture placement
- Common mistakes
- Tissue handling



Dr. Robert Acland





The "Ideal" Anastomosis

- Equal distance between neighboring sutures (α & β)
- Equal bite size, or distance between suture entry and exit points (y)
- Approximation of vessel ends such that they meet along a smooth, straight line



- a: Distance between proximal insertion points
- β: Distance between distal insertion points
- y: Length of suture placed
- R: Needle diameter

Figure 1 The Ideal Anastomosis.





Optimizing Suture Placement

- Use non-dominant hand to support vessel
- Visualize needle tip at all times from insertion to pull-through
- Travel *straight across* with equal space between bites
- Pay attention to the width of each bite
- Suture should enter at 90° to vessel wall
- Follow the curve of the needle when pulling through







Knot Tying

- I. Grasp suture with non-dominant hand 1-2 cm from the incision site, such that the tail is oriented *away* from the incision.
- 1. Make a loop by turning the suture around the tip of your needle holder, which is held in your dominant hand.
- 1. With the needle holder, grab the short end of the suture.
- 1. Complete the knot by pulling the short end through the loop, as with any other instrument tie. Do not let go of the suture with your left hand.
- 1. Repeat #2-4 to complete 3 total knots. Be sure to lay them down square.











Common Errors

Loose ("Air") Knot

Infolding







Back Wall

Poor Spacing

Basic Macro Model





Basic Macro Model: Latex Glove

Materials:

- Latex glove
- Standard needle driver
- Standard forceps
- 6-0 prolene or nylon suture
- Cardboard
- Scissors
- Tape/stapler

Template

Setup:

- 1. Cut fingers off latex glove
- 2. Cut palm in half so you have a flat piece of latex
- 3. Cut a piece of cardboard to approximately 10 x 20 cm rectangle
- 4. Place the cut fingers over the cardboard such that the open ends are in direct opposition to one another
- 5. Secure the far ends of the gloves to the cardboard using a stapler or tape

Basic Macro Model: Supplies







Basic Setup





tape glove to template



Virtual Microsurgery Course: Latex Pad Creation and Suturing





Breakout Session





Breakout Session: Basic Macro Model

Learning Objectives

- Basics of needle insertion & pull-through
- Basics of knot tying
- Basics of suture placement for an end-to-end anastomosis
- Basics of suture placement for an end-to-side anastomosis





Basic Macro Model: Latex Glove

Materials:

- Latex glove
- Standard needle driver
- Standard forceps
- 6-0 prolene or nylon suture
- Cardboard
- Scissors
- Tape/stapler

Template

Setup:

- 1. Cut a finger from a latex glove
- ¹ Cut a piece of cardboard to approximately 10 x 20 cm rectangle
- 3. Place the cut finger over the cardboard such that the open ends are in direct opposition to one another on the template
- 4. Secure the ends of the gloves to the cardboard using a stapler or tape



Basic Macro Model: Supplies







Basic Setup







Virtual Microsurgery Course: Latex Glove End to End -Macroinstruments





Virtual Microsurgery Course: Latex Glove End to Side -Macroinstruments





Breakout Session





Faculty demonstration





Basic Micro Model





Breakout Session: Basic Micro Model

Learning Objectives

- Basics of needle insertion & pull-through
- Basics of knot tying
- Basics of suture placement for an end-to-end anastomosis
- Basics of suture placement for an end-to-side anastomosis





Basic Micro Model: Latex Glove

Materials:

- Latex glove
- Micro needle driver
- Micro forceps
- 8-0 prolene or nylon suture
- Cardboard
- Scissors
- Tape/stapler

🚛 Template

Setup:

- 1. Cut a finger from a latex glove
- ¹ Cut a piece of cardboard to approximately 10 x 20 cm rectangle
- 3. Place the cut finger over the cardboard such that the open ends are in direct opposition to one another on the template
- 4. Secure the ends of the gloves to the cardboard using a stapler or tape



Basic Micro Model: Supplies







Basic Setup







Virtual Microsurgery Course: Latex Glove End to End -<u>Microinstruments</u>





Virtual Microsurgery Course: Latex Glove End to Side -<u>Microinstruments</u>





Breakout Session





Faculty demonstration





Visit the *PSF* SHARE website for more resources!



CLICK HERE!



Useful Links

• PSF SHARE

- https://www.thepsf.org/programs/surgeons-in-humanitarian-alliance-for-reconstruction-research-and-education/microsurgery-workshop-2
- Tamai S. History of Microsurgery. *Plast Reconstr Surg*. 2009; 124: 282e-294e. https://sci-hub.se/10.1097/PRS.0b013e3181bf825e.
 - History of Microsurgery
- Kim et al. described "Features of the Ideal Anastomosis" in their 2020 study published in JPRAS.
 - How to perform 'Ideal" anastomosis
- "Precondition of Microsurgical Skill"
 - https://www.youtube.com/watch?v=OXPzLAEdKhQ&ab_channel=ColumbiaOrthopedics
 - "Basic Microsuture Technique"
- https://www.youtube.com/watch?v=3tDYU3f1XfY&ab_channel=ColumbiaOrthopedics

