University of Wisconsin
Division of Plastic and Reconstructive Surgery
Microsurgery Training Curriculum
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Lesson 1

Microscope, Instruments and Basic Microsurgical Technique

Course Description – Microscope and Instruments management. Use the instruments to maneuver needle and suture, place a stitch and tie a knot on a sponge.

Models: Microscope, instruments and sponge

Hours: 2 hours

Topics:

1. Microscope management
2. Instruments management (attached table 1 of the instruments)
3. Sutures (attached table 2 of the instruments)
4. Pick up the needle
5. Needle direction
6. Placing a stitch on sponge
7. Method to pull the suture accurately and precisely while avoiding tearing the vessel
8. Tie a knot: square knot, surgeon's knot

Milestone:

1. Know the name of instruments and the methods to use them
2. Manage the microscope for individual conditions (base on inter-pupillary distance, eyesight, zoom in /out, focus, minor justify)
3. Understand the type of sutures and needles
4. Can pick up the needle and adjust the needle direction
5. Can place stitch and tie square knot, surgeon's knot

Assessment and Evaluation and Grading and Grade Determination

Perform an end-to-end anastomosis and evaluate by GRS / SMART

Lesson 2

Basic Microsurgical Technique

Course Description – Needle and suture management. Knot tying technique.

Models: Glove and sponge

Hours: 2 hours

Topics:

1. Pick up the needle
2. Adjust needle direction
3. Placing stitches on sponge or glove
4. Method to pull the suture without tearing the suture
5. Suture holding method
6. Method of Making loop
7. Tie a knot: square knot, surgeon's knot
8. Non-crossing knot tying technique

Milestone:

1. Can pick up the needle and hold it in good portion
2. Adjust the needle to right direction
3. Pull the suture without tearing the vessel
4. Can place stitch and tie square knot, surgeon's knot
5. Type knots fluently: square knot, surgical knot on glove without /with tension

Assessment and Evaluation and Grading and Grade Determination

Perform an end-to-end anastomosis and evaluate by GRS / SMART

Lesson 3

Method of End-To-End (ETE) Anastomosis

Course Description – Understand the method to perform ETE anastomosis on a fake vessel

Models: Silicon tube (1.5-2mm) / Biomed fake vessel (1.5-2mm)

Hours: 2 hours

Topics:

1. Different sequence of placing stitches.(two-stay, One-way-up, Middle-first)
2. How to judge the number of necessary stitches
3. Method of placing entry bite and exist bite
4. Method to pull the suture to avoid tearing the vessel
5. Understand how big is good for the bite.
6. Method of Making loop.
7. Tie knots in a 3D structure: square knot, surgeon's knot.
8. Non-crossing knot tying technique

Milestone:

1. Know the methods of ETE.
2. Know the sequence of placing stitches
3. Understand the needle direction.
4. Can pull the suture out without tearing the vessel
5. Can place stitch and tie square knot, surgeon's knot
6. Type knots fluently: square knot, surgical knot on different part of the tube

Assessment and Evaluation and Grading and Grade Determination

Perform an end-to-end anastomosis and evaluate by GRS / SMaRT

Lesson 4

End-To-End (ETE) Anastomosis in Chicken Thigh 1

(two-stay method 1 & 2)

Course Description – Perform ETE anastomosis on femoral A with 2 methods

Models: Blue-blood Chicken thigh model

Hours: 2 hours

Topics:

1. Microdissection (preserve the muscle and the branches)
2. Small branches ligation
3. Vessel end preparation (Strip the adventitia, dilate the vessel, place the double clamp the vessel)
4. The sequence of placing stitches for two-stay method
5. How to judge the number of necessary stitches and place stitches evenly
6. Skill of placing the first and 2nd entry bite and exist bite
7. Skill to avoid hook up the back wall
8. Method to pull the suture out without tearing the vessel
9. Understand how big is good for the bite.
10. Method of making loop
11. Skill to avoid overlap the vessel wall
12. Tie surgeon's knot while there is tension
13. Skill to place stitch when there is no enough space (2 way)
14. Non-crossing knot tying technique

Milestone:

1. Respect the tissue
2. Placing stitch dexterously
3. Placing stitches evenly
4. Biting the vessel wall in a good distance
5. Demonstrate good judgement to avoid "hooking" the back wall
6. Perform THREE patent anastomoses

Assessment and Evaluation and Grading and Grade Determination

Perform an end-to-end anastomosis and evaluate by GRS / SMART

Lesson 5

End-To-End (ETE) Anastomosis 2

(Back-wall-first)

Course Description – Perform ETE anastomosis on a vessel with One-way-up method and two-way-up method

Models: Blue-blood chicken thigh model

Hours: 2 hours

Topics:

1. Sequence of placing stitches
2. Back-hand technique
3. Expose the back wall
4. The sequence of placing stitches for one-way-up method
5. place stitches evenly
6. Tie surgeon's knot while there is tension
7. Skill to place stitch when there is no enough space (2 way)
8. Non-crossing knot tying technique

Milestone:

1. Respect the tissue
2. Placing stitch dexterously
3. Placing stitches evenly
4. Biting the vessel wall in a good distance
5. Demonstrate good judgement and skill to avoid "hooking" the back wall
6. Perform THREE patent Anastomoses

Assessment and Evaluation and Grading and Grade Determination

Perform an end-to-end anastomosis and evaluate by GRS / SMART

Lesson 6

End-To-End (ETE) Anastomosis ETE Integrated Practice

Course Description – Perform ETE anastomosis on femoral A with FOUR different methods.

Models: Blue-blood Chicken thigh model

Hours: 2 hours

Topics:

1. Sequence of placing stitches
2. Back-hand technique
3. Expose the back wall
4. The sequence of placing stitches for one-way-up method
5. Place stitches evenly
6. Tie surgeon's knot while there is tension.
7. Develop skills to place stitches when there is not enough space (2 way)
8. Tying knots without crossing hands

Milestone:

1. Respect the tissue
2. Placing stitch dexterously
3. Placing stitches evenly
4. Biting the vessel wall with accurate spacing
5. Develop the judgement and skills to avoid "hooking" the back wall
6. Perform THREE patent anastomoses

Assessment and Evaluation and Grading and Grade Determination

Perform an end-to-end anastomosis and evaluate by GRS / SMART

Lesson 7

Nerve Repair (ETE & ETS)

Course Description – Use femoral nerve/ branch to perform nerve coaptation neurrorhaphy with epineurial and perineurial repair.

Models: Blue-blood chicken thigh model

Hours: 2 hours

Topics:

1. Isolate and prepare the nerve
2. Identify the hallmark to line up the nerve stem using the different size of the fascicles and vessel on the epineurium
3. ETS window opening

Milestone:

1. Understand the importance of lining up the distal and proximal stumps.
2. Place stitchs superficially and only place suture is the epineurium /perineurium
3. Perform FOUR precise repairs

Assessment and Evaluation and Grading and Grade Determination

Perform an end-to-end and end-to-side coaptation and evaluate by GRS / SMART

Lesson 8

End-To-End (ETE) Anastomosis of Vein

Course Description – Perform ETE anastomosis on femoral Vein with different methodologies.

Models: Blue-blood chicken thigh model

Hours: 2 hours

Topics:

1. Sequence of placing stitches
2. Back-hand technique
3. Expose the back wall
4. The sequence of placing stitches for one-way-up method
5. Place stitches evenly
6. Tie surgeon's knot while there is tension
7. Develop skills to place stitches when there is not enough space (2 way)
8. Tie knots without crossing hands

Milestone:

1. Respect the tissue
2. Placing stitch dexterously
3. Placing stitches evenly
4. Biting the vessel wall in a good distance
5. Demonstrate good judgement and skill not avoid "hooking" the back wall
6. Perform THREE patent anastomoses

Assessment and Evaluation and Grading and Grade Determination

Perform an end-to-end anastomosis and evaluate by GRS / SMART

Lesson 9

End-To-Side (ETS) Anastomosis A-V 1

Course Description – Perform ETS anastomosis of artery to vein using standard and back-wall-first methodologies

Models: Blue-blood chicken thigh model

Hours: 2 hours

Topics:

1. Sequence of placing stitches (and understanding the importance of this)
2. Back-hand technique
3. Expose the back wall (always try to expose the back wall to a position where is easy and accessible)
4. The orientation of the needle and stitches

Milestone:

1. Respect the tissue
2. Placing stitch dexterously
3. Placing stitches evenly and in radial orientation
4. Biting the vessel wall at an appropriate distance
5. Demonstrate good judgement and skill not to hook up the back wall
6. Perform THREE patent anastomoses

Assessment and Evaluation and Grading and Grade Determination

Perform an end-to-end anastomosis and evaluate by GRS / SMART

Lesson 10

End-To-Side (ETS) Anastomosis 2

Small Vessel (D=1.5mm)

Course Description – Perform ETS anastomosis on branches of femoral Artery/ Vein (D=1.5mm) to vein/artery style with regular method and back-wall-first method.

Models: Blue-blood chicken thigh model

Hours: 2 hours

Topics:

1. Importance of sequencing the placement of stitches
2. Back-hand technique
3. Expose the back wall (always try to expose the back wall to a position where it is easy and accessible).
4. Discuss the orientation of the needle and stitches.

Milestone:

1. Respect the tissue
2. Placing stitch dexterously
3. Placing stitches evenly and in radial orientation
4. Biting the vessel wall in a good distance
5. Demonstrate good judgement and skill to avoid “hooking” the back wall
6. Perform THREE patent anastomoses

Assessment and Evaluation and Grading and Grade Determination

Perform an end-to-end anastomosis and evaluate by GRS / SMART

Lesson 11

Vein Graft, A-V loop (ETS)

Course Description – Use the femoral vein / branch to perform vein graft and A-V loop between femoral vessels

Models: Blue-blood chicken thigh model

Hours: 2 hours

Topics:

1. Prepare the vein graft.(remember to reverse the direction of the vein when performing vein grafting).
2. Measure the length when the A and V still intact.
3. Start the anastomosis of from right side (right-handed)
4. Irrigate the blood away from the first anastomosis after test to avoid forming blood clot.
5. Strike along the vessel before starting the second anastomosis to make sure the vessel is not twisted, which is a common cause of spasm and formation of blood clot.
6. Window opening technique
7. The importance of radial suturing (ETS)
8. The orientation of the needle and stitches

Milestone:

1. Respect the tissue
2. Reverse the vein (graft to A).
3. Remove the twist of the vein(twist of the vessel is a common cause of blood clot)
4. Placing stitch dexterously
5. Placing stitches evenly and in radial orientation
6. Biting the vessel wall in a good distance
7. Demonstrate good judgement and skill to avoid “hooking” the back wall
8. Perform THREE patent anastomoses

Assessment and Evaluation and Grading and Grade Determination

Perform an end-to-end anastomosis and evaluate by GRS / SMART

Lesson 12

Small Vessel ETE (D=1mm)

Course Description – Use femoral A/V branches to Perform ETE anastomosis (D=1mm).

Models: Blue-blood chicken thigh model

Hours: 2 hours

Topics:

1. Microdissection (preserve the muscle and the branches)
2. Small branches ligation
3. Vessel end preparation (Strip the adventitia, dilate the vessel, place the double-opposing vascular clamp across the vessel)
4. The sequence of placing stitches for two-stay method
5. How to judge the number of necessary stitches and place stitches evenly
6. Skill of placing the first and 2nd entry bite and exist bite
7. Skill to avoid hooking the back wall
8. Method to pull/manipulate the suture precisely and without tearing the vessel
9. Understand how large the bite should be.
10. Method of making the stitch loop.
11. Skill to avoid overlap the vessel wall
12. Tie surgeon's knot while there is tension
13. Skill to place stitch when there is no enough space (2 way)
14. Non-crossing knot tying technique

Milestone:

1. Respect the tissue
2. Placing stitch dexterously
3. Placing stitches evenly
4. Biting the vessel wall demonstrating good judgement of distance
5. Demonstrating good judgement and skill to avoid "hooking" the back wall
6. Perform THREE patent anastomoses

Assessment and Evaluation and Grading and Grade Determination

Perform an end-to-end anastomosis and evaluate by GRS / SMART

Lesson 13

Small Vessel ETS (D=1mm)

Course Description – Use femoral A/V branches to Perform ETS anastomosis (D=1mm).

Models: Blue-blood Chicken thigh model

Hours: 2 hours

Topics:

1. Sequence of placing stitches
2. Back-hand technique
3. Expose the back wall
4. The sequence of placing stitches for one-way-up method
5. Place stitches evenly
6. Tie surgeon's knot while there is tension
7. Skill to place stitch when there is no enough space (2 way)
8. Non-crossing knot tying technique

Milestone:

1. Respect the tissue
2. Placing stitch dexterously
3. Placing stitches evenly
4. Biting the vessel wall in a good distance
5. Demonstrating good judgement and skill to avoid "hooking" the back wall
6. Perform THREE patent anastomoses

Assessment and Evaluation and Grading and Grade Determination

Perform an end-to-end anastomosis and evaluate by GRS / SMART

Lesson 14

Small Vessel Graft (D=1mm)

Course Description – Use femoral A/V branch to Perform vein graft between femoral vessels (D=1mm)

Models: Blue-blood Chicken thigh model

Hours: 2 hours

Topics:

1. Prepare the vein graft (remember to reverse the direction of the vein when performing a vein graft)
2. Measure the length when the A and V are still intact
3. Begin the anastomosis from the right side (right-handed)
4. Irrigate the blood away from the first anastomosis after test to avoid forming blood clot
5. Strike along the vessel before starting the second anastomosis to make sure the vessel is not twisted, which is a common cause of spasm and formation of blood clot
6. Window opening technique
7. The importance of radial suturing (ETS)
8. The orientation of the needle and stitches

Milestone:

1. Respect the tissue
2. Reverse the vein (graft to A).
3. Remove the twist of the vein(twist of the vessel is a common cause of blood clot)
4. Placing stitch dexterously
5. Placing stitches evenly and in radial orientation
6. Demonstrate judgement in knot spacing
7. Demonstrate good judgement and skill to avoid “hooking” the back wall
8. Perform THREE patent anastomoses

Assessment and Evaluation and Grading and Grade Determination –

Perform an end-to-end anastomosis and evaluate by GRS / SMART

Lesson 15

Live Animal Training

Rat Femoral ETE ETS V Graft, Nerve repair

Course Description – Perform ETE, ETS, V graft and nerve repair in a live rat on femoral A/V, Common Carotid A, external/internal jugular veins and sciatic nerve

Models: Adult rat

Hours: 5 hours

Topics:

1. Microdissection (push-cut: push to create safe space then cut)
2. Small branches ligation
3. Vessel end preparation (strip the adventitia, dilate the vessel, place the double-opposing microvascular clamp across the vessel)
4. The sequence of placing stitches for two-stay method
5. How to judge the number of necessary stitches and place stitches evenly
6. Skill of placing the first and 2nd entry bite and exist bite
7. Skill to avoid hook up the back wall
8. Method to pull the suture without tearing the vessel
9. Understand how big is good for the bite.
10. Method of Making loop.
11. Skill to avoid overlap the vessel wall
12. Tie surgeon's knot while there is tension.
13. Skill to place stitch when there is no enough space (2 way)
14. Non-crossing knot tying technique

ETS:

15. Sequence of placing stitches
16. Back-hand technique
17. Expose the back wall (always try to expose the back wall to a position where it is easily accessible
18. The orientation of the needle and stitches

Vein Graft:

19. Prepare the vein graft.(remember to reverse the direction of the vein when graft to artery)
20. Measure the length when the A and V still intact.
21. Start from the anastomosis of right side(right-handed)
22. Irrigate the blood away from the first anastomosis after test to avoid forming blood clot

23. Strike along the vessel before starting the second anastomosis to make sure the vessel is not twisted, which is a common cause of spasm and formation of blood clot
24. Window opening technique
25. The importance of radial suturing (ETS)
26. The orientation of the needle and stitches

Milestone:

1. Respect the tissue
2. Placing stitch dexterously
3. Placing stitches evenly
4. Placing stitches evenly and in radial orientation in ETS
5. Biting the vessel wall in a good distance
6. Demonstrate good judgement and skill to avoid “hooking” the back wall
7. Perform THREE patent anastomoses with ETN, ETS, V graft

Assessment and Evaluation and Grading and Grade Determination

Perform an end-to-end anastomosis and evaluate by GRS / SMART

Lesson 16

Live Animal Training

Hind limb replantation, free flap (Epigastric Free Flap)

Course Description – Perform Hind limb replantation and transplantation and Epigastric Free Flap

Flap transfer to neck in rat.

Models: Experience Rat

Hours: 5 hours

Topics:

Hind limb replantation

https://onlinelibrary.wiley.com/doi/epdf/10.1002/%28SICI%291098-2752%282000%2920%3A1%3C42%3A%3AAID-MICR8%3E3.0.CO%3B2-4

Hind limb Transplantation

1.

https://www.jove.com/video/53483/orthotopic-hind-limb-transplantation-in-the-mouse

2.

https://www.jove.com/video/2022/orthotopic-hind-limb-transplantation-in-rats

Epigastric Free Flap

https://www.jove.com/video/55281/a-model-of-free-tissue-transfer-the-rat-epigastric-free-flap

Tops:

1. Microdissection (Push-cut: push to create safe space then cut)
2. Small branches ligation
3. Vessel end preparation (Strip the adventitia, dilate the vessel, place the double clamp the vessel)
4. The sequence of placing stitches for two-stay method
5. How to judge the number of necessary stitches and place stitches evenly
6. Skill of placing the first and 2nd entry bite and exist bite
7. Skill to avoid hook up the back wall

8. Method to pull the suture out without mess up.
9. Understand how big is good for the bite.
10. Method of Making loop.
11. Skill to avoid overlap the vessel wall
12. Tie surgeon's knot while there is tension.
13. Skill to place stitch when there is no enough space(2 way)
14. Non-crossing knot tying technique

ETS:

15. Sequence of placing stitches(is important)
16. Back-hand technique
17. Expose the back wall (Always try to expose the back wall to the position where is easy to work on it.)
18. The orientation of the needle and stitches.

Vein Graft:

19. Prepare the vein graft.(remember to reverse the direction of the vein when graft to artery)
20. Measure the length when the A and V still intact.
21. Start from the anastomosis of right side(right-handed)
22. Irrigate the blood away from the first anastomosis after test to avoid forming blood clot.
23. Strike along the vessel before starting the second anastomosis to make sure the vessel is not twisted, which is a common cause of spasm and formation of blood clot.
24. Window opening technique
25. The importance of radial suturing (ETS)
26. The orientation of the needle and stitches.

Milestone:

1. Respect the tissue
2. Placing stitch dexterously
3. Placing stitches evenly
4. Placing stitches evenly and in radial orientation in ETS
5. Biting the vessel wall in a good distance
6. Demonstrate judgement and skill to avoid "hooking" the back wall
7. Flap and limb survival for 2 hours.

Assessment and Evaluation and Grading and Grade Determination

Perform an end-to-end anastomosis and evaluate by GRS / SMART