



A CURRICULUM FOR SURGICAL INTERNS

# The “HOW TO” Book of Low Cost Surgical Simulation

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# Introduction

Although academic institutions have trained surgical residents using cadavers, animals, and mock oral exams for decades, the majority of clinical training has always been on human beings (real, live patients). Surgeons have long respected the sanctity of operating on another human being, said best by *Dr. Alec Walt*,

***“The concept that one citizen will lay himself horizontal and permit another to plunge a knife into him, take blood, give blood, rearrange internal structures at will, determine ultimate function, indeed, sometimes life itself — that responsibility is awesome both in the true and in the currently debased meaning of the word.”***

Indeed, *Dr. Will Mayo* in 1923 stated,

***“There is no longer the need to practice on real patients.”***

It is from the shoulders of these revered and humble giants as well as the innovators in aviation, computers, robotics, anesthesiology, and adult learning theorists that modern surgical educators now gravitate towards the benefits of simulation. The Mayo Clinic Multidisciplinary Simulation Center opened its doors in October of 2005 and allowed our General Surgery training program to begin formally using a simulation curriculum to teach, train, assess and remediate our surgical learners.

While we are proud of our efforts in surgical simulation, this book represents an imperfect effort to turn novice surgical trainees into insightful and competent surgeons. Our curriculum remains a work in progress and we appreciate the feedback from readers of this text on how to continue to improve and advance surgical simulation to the betterment of all trainees. This compilation records the current low fidelity, low cost, high repetition surgical simulation curriculum for our interns in 2018-2019.

Selfishly, this book was created for two reasons: 1) to offer our cookbook of simulation recipes for other educators that have asked for it, and 2) to better record what we do to allow our own simulation staff and educators better preparation to guide and improve upon the sessions we run. I thank you for your interest in our work, and we hope you find the “HOW TO” Book of Low Cost Surgical Simulation engaging, cost effective, time-saving, and beneficial to you and your program.

**David Farley, M.D.**

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# Abbreviations

|      |                                       |        |   |
|------|---------------------------------------|--------|---|
| ABC  | Airway, breathing and circulation     | EKG    | Electrocardiogram                             |
| ABG  | Arterial blood gas                    | ER     | Emergency room                                |
| ABS  | American Board of Surgery             | ET     | Endotracheal                                  |
| ACLS | Advanced cardiac life support         | EUS    | Endoscopic ultrasonography                    |
| AED  | Automated external defibrillator      | FAST   | Focused assessment with sonography for trauma |
| ALT  | Alanine transaminase                  |        |   |
| AP   | Anterior-posterior                    | FLS    | Fundamentals of Laparoscopic Surgery          |
| AST  | Aspartate transaminase                |        |   |
| ATLS | Advanced trauma life support          | Fr     | French gauge system                           |
| BCT  | Breast conserving therapy             | Fx     | Fracture                                      |
| BVM  | Bag valve mask                        | GB     | Gallbladder                                   |
| BP   | Blood pressure                        | GCS    | Glasgow coma scale                            |
| bpm  | Beats-per-minute                      | GFR    | Glomerular filtration rate                    |
| Bx   | Biopsy                                | GJ     | Gastrojejunostomy                             |
| CBC  | Complete blood cell count             | HD     | High definition                               |
| CBD  | Common bile duct                      | HJ     | Hepatojejunostomy                             |
| CC   | Cranial-caudal                        | HPB    | Hepato-pancreato-biliary                      |
| CCA  | Common carotid artery                 | HPT    | Hyperparathyroidism                           |
| CEA  | Carcinoembryonic antigen              | HR     | Heart rate                                    |
| CHD  | Common hepatic duct                   | HTN    | Hypertension                                  |
| cm   | Centimeter                            | Hx     | History                                       |
| CO   | Cardiac output                        | ICP    | Intracranial pressure                         |
| COPD | Chronic obstructive pulmonary disease | ICU    | Intensive care unit                           |
|      |                                       | IH     | Inguinal hernia                               |
| CPAP | Continuous positive airway pressure   | IJ     | Internal jugular                              |
| CPR  | Cardiopulmonary resuscitation         | IMV    | Intermittent mandatory ventilation            |
| CRI  | Chronic renal insufficiency           | INR    | International normalized ratio                |
| CT   | Computed tomography                   | IOUS   | Intraoperative ultrasonography                |
| CVP  | Central venous pressure               | IV     | Intravenous                                   |
| CXR  | Chest x-ray                           | IVC    | Inferior vena cava                            |
| DCIS | Ductal carcinoma in-situ              | IVF-LR | Intravenous fluid - lactated Ringer's         |
| DDx  | Differential diagnosis                | KUB    | Kidneys, ureters and bladder                  |
| DM   | Diabetes mellitus                     | L      | Left  |
| DVT  | Deep vein thrombosis                  | MACIS  | Mayo scoring system for PTC                   |
| Dx   | Diagnosis                             | MD     | Doctor of Medicine                            |

|      |   |      |   |
|------|---|------|---|
| mm   | millimeter                                      | SMA  | Superior mesenteric artery                      |
| MRM  | Modified radical mastectomy                     | SMV  | Superior mesenteric vein                        |
| MVA  | Motor vehicle accident                          | SubQ | Subcuticular                                    |
| NPA  | Nasopharyngeal airway                           | SVR  | Systemic vascular resistance                    |
| NPO  | Nil per os                                      | SVT  | Supraventricular tachycardia                    |
| NSR  | Normal sinus rhythm                             | TAPP | Transabdominal preperitoneal                    |
| OPA  | Oropharyngeal airway                            | TE   | Tracheo-esophageal                              |
| OR   | Operating room                                  | TEP  | Totally extraperitoneal                         |
| PA   | Posterior-anterior                              | TNM  | (tumor, nodes, metastasis) tumor staging system |
| PA   | Pulmonary artery                                | TSH  | Thyroid stimulating hormone                     |
| PC   | Personal computer/laptop                        | U/S  | Ultrasound                                      |
| PD   | Pancreatic duct                                 | UO   | Urine output                                    |
| PD   | Pancreatoduodenectomy                           | UOB  | Up & out of bed                                 |
| PDS  | Polydioxanone suture                            | VATS | Video-assisted thoracoscopic surgery            |
| PE   | Pulmonary embolism                              | VF   | Ventricular fibrillation                        |
| PEA  | Pulseless electrical activity                   | VHR  | Ventral hernia repair                           |
| PEEP | Positive end-expiratory pressure                | VT   | Ventricular tachycardia                         |
| PGY  | Postgraduate year                               | XRT  | Radiation therapy                               |
| PJ   | Pancreatojejunostomy                            |      |   |
| PMHx | Past medical history                            |      |   |
| POD  | Post operative day                              |      |   |
| PPV  | Positive predictive value                       | ➤    | Link/cross-reference                            |
| PTC  | Papillary thyroid cancer                        |      |   |
| PTH  | Parathyroid hormone                             |      |   |
| PTx  | Pneumothorax                                    |      |   |
| PV   | Portal vein                                     |      |   |
| Q&A  | Question(s) & answer(s)                         |      |   |
| Qs   | Questions                                       |      |   |
| R    | Right   |      |   |
| RBC  | Red blood cells                                 |      |   |
| RLN  | Recurrent Laryngeal Nerve                       |      |   |
| RLQ  | Right lower quadrant                            |      |   |
| ROSC | return of spontaneous circulation               |      |   |
| RUQ  | Right upper quadrant                            |      |   |
| RYGB | Roux-en-y gastric bypass                        |      |   |
| SB   | Small bowel                                     |      |   |
| SBO  | Small bowel obstruction                         |      |   |
| sec  | Second  |      |   |
| Sim  | Simulation                                      |      |   |
| SIMV | Synchronized intermittent mandatory ventilation |      |   |
| SLN  | Sentinel lymph node                             |      |   |
| SM   | Simple mastectomy                               |      |   |

# Getting Started

## Words of Advice

1. Do not be overwhelmed with this book. Use only the parts of it that appeal to you and your learners. It is a reference book. It is NOT a template for others to follow verbatim. We do have 13 years of experience with teaching 30+ Mayo surgical interns each year and have found that these sessions, models, and repetitions have served our learners and staff well.
2. Surgical educators are short on money, time, and manpower. Our sessions are thus based on efficiency. We frequently use inexpensive material, models created by learners themselves (in Boot Camp) or by Mayo medical students (Surgery Interest Group). Sessions run best with learners in pairs or small groups working together with intermittent staff input.
3. Any surgical simulation session that gets learners using their hands, asking questions, and working together to problem solve is a positive educational effort.
4. Remind learners: sharp instruments are sharp. Be careful with needles & scalpels.



5. This book is designed to offer you the gamut of simulated operative scenarios, debriefing topics, pearls and pitfalls. In addition, it provides pictures, instructions, and videos (online version) on how to create low cost models that can be used throughout your simulation curriculum.
6. This book is the “playbook” for our General Surgery training program - which is likely far different from yours. You will find additional scenarios, scene setups and adjunctive materials within the appendix to adapt to your curriculum design and your learners’ needs. The box of stressor or challenge questions is rarely used by us unless we have large numbers of learners in the Operating Room (OR); we use them to help keep all learners engaged.
7. Use, alter, and discard the ideas and lessons as you see fit. Do NOT be intimidated. Dozens of visitors observing our trainees in action with simulation invariably: 1) smile, 2) develop an upbeat, can-do attitude, and 3) comment “we can do this!”.

Contact us with questions, concerns and feedback at [Farley.David@mayo.edu](mailto:Farley.David@mayo.edu) or (507) 284-2095. We are happy to host visitors (no charge!) to observe our Friday Surgical Simulation sessions and assessments. We enjoy networking and collaborating to improve surgical education.

## Simulation Education Academic Year

Our surgical simulation efforts are heavily weighted towards surgical interns. We meet every Friday morning (9:00 am - 12:00 pm) from July to early May. Most of our ~40 sessions are consistent 3 hour sessions that focus on a solitary topic within General Surgery (hernia, breast, thyroid, etc.) or a specific surgical specialty (colorectal, vascular, etc.). The outline below gives you a rough guide to our academic year with early emphasis on overall assessment and a few bread and butter procedures.

### Introductory Sessions

- Week 1      Boot Camp & Orientation
- Week 2      Summer Surgical Olympics

### Workshops

- Week 3      Tube Thoracostomy
- Week 4      Ventilators
- Week 5      Central Line Placement

### Surgical Sessions

- Week 6      Surgery 101
- Week 7      Surgery 102
- Week 8      Hernia
- Week 9      Anastomosis/Stomas
- Week 10      Breast
- Week 11      Thyroid & Parathyroid
- Week 12      Hepato-Pancreato-Biliary Surgery
- Week 13      Laparoscopy 101
- Week 14      Laparoscopy 102
- Week 15      Code 101: ACLS
- Week 16      Code 102: Trauma
- Week 17      Adrenals
- Week 18      Pediatric Surgery
- Week 19      Winter Surgical Olympics
  
- Week 20      ABSITE - No sim session
- Week 21      Colon and Rectum

|         |                            |
|---------|----------------------------|
| Week 22 | Melanoma                   |
| Week 23 | Thoracic Surgery           |
| Week 24 | Vascular Surgery           |
| Week 25 | Bariatric Surgery          |
| Week 26 | Pancreas                   |
| Week 27 | Small Bowel                |
| Week 28 | Stomach                    |
| Week 29 | Transplantation Surgery    |
| Week 30 | Ultrasound                 |
| Week 31 | Gallbladder                |
| Week 32 | Liver                      |
| Week 33 | Spleen                     |
| Week 34 | Lumps, Bumps and Excisions |
| Week 35 | Plastic Surgery            |
| Week 36 | Urologic Surgery           |
| Week 37 | Surgical Oncology          |
| Week 38 | Trauma                     |
| Week 39 | Cardiac Surgery            |
| Week 40 | Test Out                   |

## Chapter 1

---

# Boot Camp

Boot Camp is a week-long effort by the Mayo Clinic General Surgery program to orient, welcome, and educate new surgical interns. Lectures, discussions, computer training, and tours attempt to educate trainees about our Mayo system.





At boot camp, several Simulation Center sessions are offered to better prepare trainees for their future educational simulation sessions and present them with key basic surgical skills to facilitate their transition from student to physician.

## **Boot Camp 5-Day Outline**

As performed by many other institutions, our Boot Camp orientation includes multiple 30-minute talks and discussion on:

- Intern expectations
- How to do proper hand-offs
- Team dynamics and schedules
- How to give a great talk
- Paging etiquette
- How to read basic radiologic images

There are two 3-hour sessions on using our electronic medical record and one 3-hour session for the Simulation Center orientation. Trainees also participate in a campus-wide scavenger hunt, team building activities, quizzes, and memory games. Our goal is to get interns active and engaged with each other each morning and afternoon. Separate evening activities include a picnic (with family), a formal dinner with staff and an intern-only gathering.

## **Overarching Goals**

- Develop camaraderie among the interns, and familiarity with our Simulation Center.
- Assure interns have a basic understanding of surgical instruments and how to hold them.
- Assure learners can tie a square knot.
- Expose learners to different methods to close fascia, approximate skin, and secure drainage tubes.
- Interns must understand asking for help is a safe and wise thing to do.

## Objectives & Outlines

This section focuses purely on the 3-hour Simulation Center session during Boot Camp. Trainees are guided on a tour. They are given access to the task trainer room, password access to the task trainers, and start preliminary practice on laparoscopic and computer trainers. Learners handle, feel, and identify dozens of surgical instruments with surgical staff showing proper usage of each instrument.



Figure 1.1 – Intern practicing on the colonoscopy simulator

### ▣ Objectives:

- Accurately identify 30 surgical instruments.
- Close the skin securely and accurately in a subcuticular fashion.
- Secure a drain to the skin with no air knots.

### Boot Camp Simulation Center Activities Outline

- 9:00            Simulation center tour
- 9:15            Task trainer registration/access
- 9:30            Review OR instruments and use
- 10:00           Demonstration on 1<sup>st</sup> assisting
- 10:15           Deliberate practice
- 10:45           Demonstration on knot tying and suturing skills
- 11:15           Deliberate practice and debriefing
- 12:00           Adjourn

# Evaluation during Boot Camp

We are advocates of frequent “low stakes” assessment. Short quizzes on the topic at hand as well as subject matter previously covered or soon to be covered are common during Boot Camp. Expectations are not to score 100% on each quiz, but errors are discussed and desirable difficulties aid in long-term retention. Here is such a sample quiz with many questions far removed from the focused teaching of this session.

## ♦ Boot Camp Pre/Post Test ♦

1. The recurrent laryngeal nerve lies \_\_\_\_\_ for most of its length.
  - a) along the trachea
  - b) within the TE groove
  - c) along the esophagus
  - d) within the thyroid gland
2. The perfect mastectomy skin flap \_\_\_\_\_.
  - a) is < 2 mm thick
  - b) is ~ 4 mm thick
  - c) is ~ 10 mm thick
  - d) does not transect Cooper ligaments
3. List 5 characteristics of a good anastomosis.
4. Name the instrument.



5. Name the clamps.

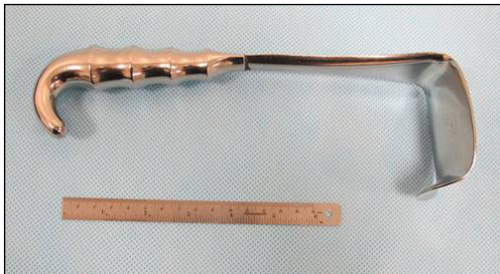


6. Name the retractors.

a)



b)



c)



7. How many full 24-hour days must you have off in 4 weeks?

8. To count an operative procedure as a 'case', an intern has to do what portion of the procedure?



9. Which of the following is NOT part of the ATLS primary survey?
- a) airway assessment
  - b) inspection/palpation of the neck
  - c) assessment of ventilation
  - d) control life-threatening hemorrhage
10. The sensitivity of a rectal exam in blunt trauma patients to identify injuries of the spinal cord, urethra, and pelvis, is high.
- a) True
  - b) False
11. Intracranial pressure (ICP) should be kept below \_\_\_\_\_ mmHg in patients with severe head trauma.
- |       |       |       |       |
|-------|-------|-------|-------|
| a) 18 | b) 20 | c) 22 | d) 24 |
| e) 26 | f) 28 | g) 30 | h) 32 |
12. The 8-hour rule for ACGME duty hours means ...?

◆ End of Test ◆

◆ Boot Camp Test - Answer Sheet ◆

1. ☐ a ☐ b ☐ c ☐ d

2. ☐ a ☐ b ☐ c ☐ d

3. \_\_\_\_\_  
\_\_\_\_\_

4. \_\_\_\_\_

5. a) \_\_\_\_\_  
b) \_\_\_\_\_

6. a) \_\_\_\_\_  
b) \_\_\_\_\_  
c) \_\_\_\_\_

7. \_\_\_\_\_

8. \_\_\_\_\_

9. ☐ a ☐ b ☐ c ☐ d

10. ☐ True ☐ False

11. ☐ a ☐ b ☐ c ☐ d  
☐ e ☐ f ☐ g ☐ h

12. \_\_\_\_\_

## ♦ Boot Camp Test - Answer Key ♦

1. b) within the TE groove.
2. c) is ~ 10 mm thick
3. Air tight - Adequate blood supply - no distal obstruction  
- patent - tension free
4. Metzenbaum scissors
5. a) Babcock  
b) Allis
6. a) Army Navy  
b) Richardson  
c) Senn
7. 4 days
8. a critical portion
9. b) inspection/palpation of neck
10. b) False
11. b) 20
12. Time between shifts in the hospital must be at LEAST 8 hours



## Chapter 2

# Surgical Olympics

All trainees deserve an unbiased, fair, and comprehensive assessment. Our Surgical Olympics offers clearly defined learning objectives, constructive feedback in a timely fashion, and score determinants are made transparent and readily available.



# Station Rotation

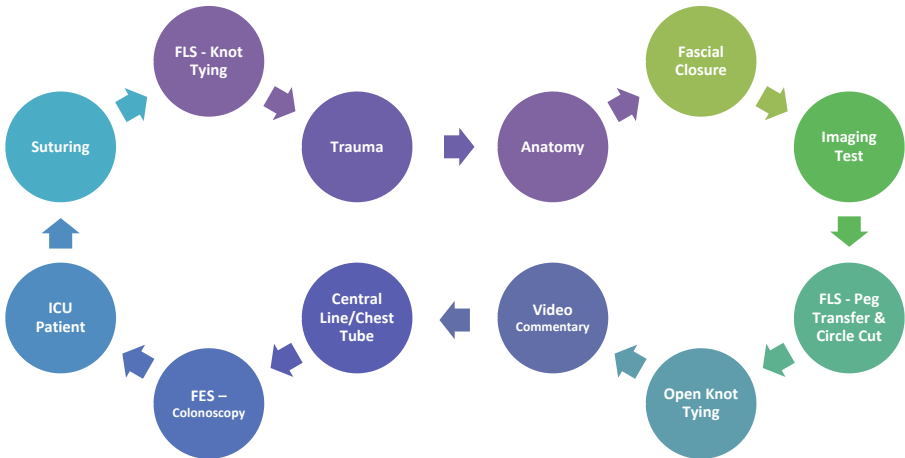


Figure 2.1 – Surgical Olympics stations (July 2018)

We started our Olympics in January of 2006. It is our attempt to objectively assess trainees – giving learners feedback and a baseline from which to build on. It is composed of twelve separate stations which are 7 minutes each (totaling 1 hour and 24 minutes of actual testing) with one minute in between. Of the 12 stations, some stations require two tasks that are each allotted a specific time limit.

There are a total of 24 Olympians in our program that undergo this assessment in a single day (two separate 96-min sessions). We evaluate their surgical knowledge and technical skills.

## Overarching Goals

- Provide trainees with an initial knowledge and skills assessment.
- Provide our residency program leadership with some sense of our learners' skill and knowledge deficiencies.



Figure 2.2 – Briefing prior to the start of the Surgical Olympics

## Objectives

1. Provide our learners objective feedback on their current surgical knowledge and abilities.
2. Offer clear expectations of performance expected of surgical interns on the forthcoming winter Surgical Olympics:
  - Perform the 7 steps of a safe insertion of a chest tube.
  - Perform FLS peg transfer and laparoscopic knot tying in under 300 seconds each.
  - Correctly interpret two ABGs in 45 seconds each.
  - Articulate 6 facts while reading a single chest radiograph in 30 sec.
  - Tie 10 right-handed, left-handed and two-handed knots in 30 sec (each).
  - Verbalize pertinent facts while viewing operative video.
  - Access the right internal jugular vein safely in 30 sec.
  - Close an 11 cm fasciotomy securely in 3 minutes.
  - Perform a cricothyrotomy in 45 sec.
3. Give learners a positive sense and dynamic opportunity to experience what simulation training and assessment might offer them.

# Station Instructions

## Station 1 » Trauma

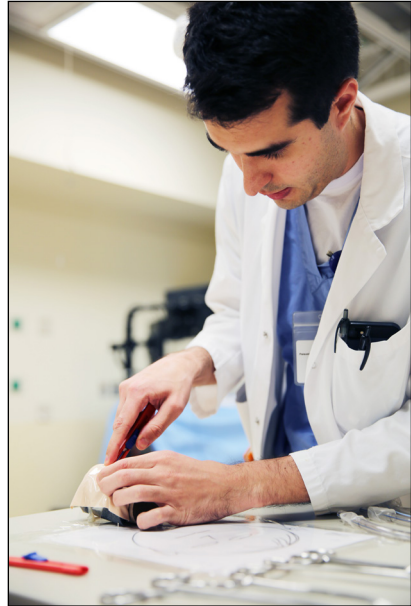
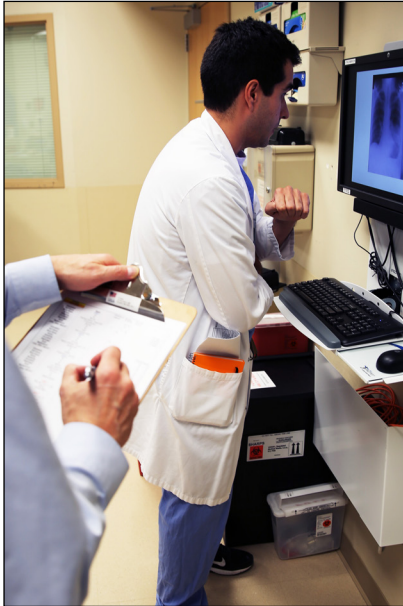


Figure 2.3 – Intern reading a CXR (left), performing a cricothyrotomy (right)

You will be asked to look at 3 chest x-rays, and verbalize what you see. You have 30 seconds per film to articulate normal and abnormal findings.

You will be shown two arterial blood gases (ABGs), and are expected to verbalize what you see and how you interpret these ABGs. You will have 45 seconds per ABG.

Lastly, you will be expected to perform a cricothyrotomy on a patient who has suddenly lost their airway. They are completely obtunded, and you need to secure an airway in 45 seconds. While doing so, please verbalize what you are doing (do NOT cut yourself).



## Station 2 » Imaging Test

1. Answer the questions to the best of your ability.
2. You have 7 minutes maximum.
3. Place your completed test in the box provided.

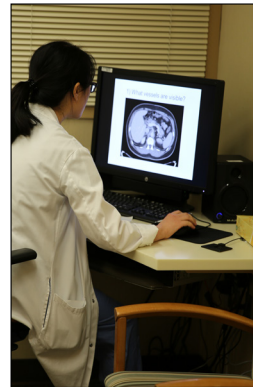
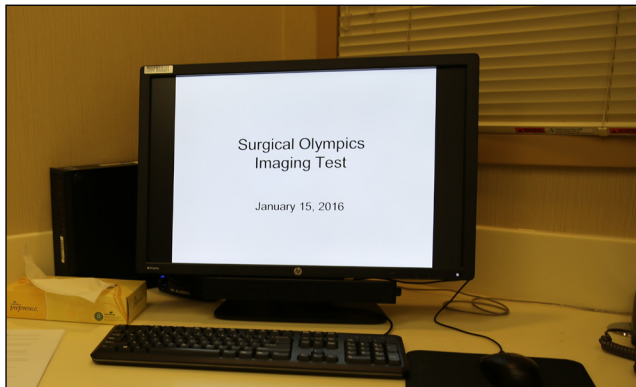


Figure 2.4 – PC showing the test (left), Intern taking the test (right)

## Station 3 » Central Line & Tube Thoracostomy

### Chest Tube Placement

In this station you are asked to perform the steps to safely and properly place a chest tube. Securement is NOT required. Verbalize steps as they are performed. Please use caution when working with the scalpel.

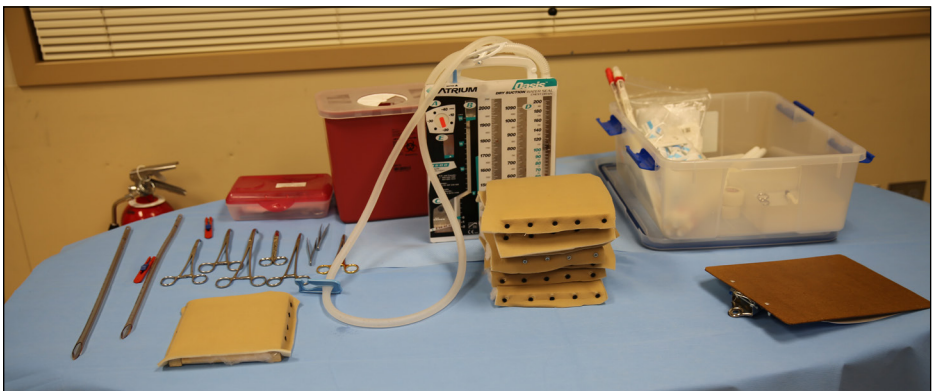


Figure 2.5 – Chest tube placement station setup



## **Central Line**

In this room, you will use the ultrasound (U/S) equipment, syringe, needle, and central line mannequin to create a teaching video. Make yourself comfortable with the U/S probe, the U/S machine, the gel, and the syringe/needle. Then, you must create a 30-second video clip that shows YOU, as the star actor/actress, using the U/S probe and machine to safely gain access into the RIGHT internal jugular vein.

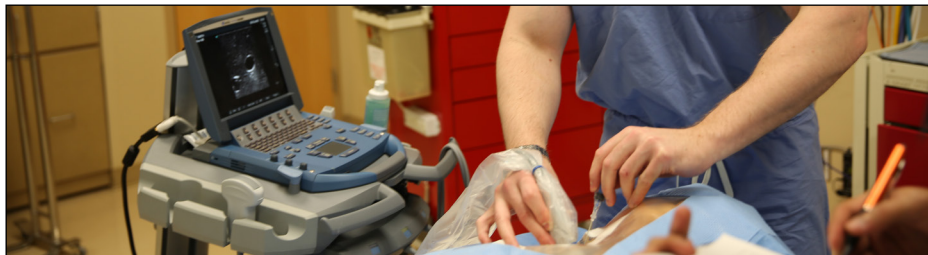


Figure 2.6 – Right IJ vein access using ultrasound guidance

### **Guidelines for the video clip:**

1. Say: “Action” to start and “Cut” to stop your take (Overhead camera is always rolling.)
2. The finished product should be 30 seconds or less.
3. Show how the US guides your needle into the right IJ vein.
4. Do NOT draw back on the syringe. No bloodletting!
5. You may “shoot” two takes.
6. Verbalize well so we can hear you.

## Station 4 » Abdominal Anatomy

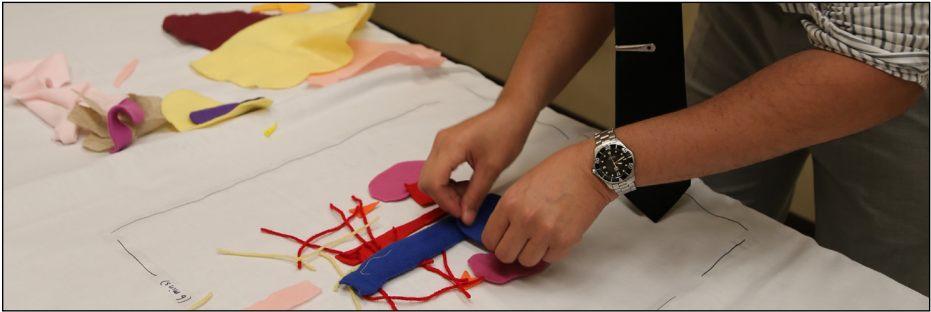


Figure 2.7 – Assembling the anatomy of the abdomen using felt pieces

Use the pieces of felt and fabric to create an accurate representation of the UPPER abdomen (caudal to diaphragm, cephalad to iliac artery bifurcation). There are no musculoskeletal or abdominal wall pieces.

Place the pieces accurately. You get 1 point for every correct fact that is **VERBALIZED** and 1 point for placing it in the correct **LOCATION**. Relationship to other structures is important.

« *HINT: Build your model from posterior to anterior* »

## Station 5 » Knot Tying

On each test, your knots are expected to be secure (penalty for air knots) and square. On the wooden dowel, place 10 throws using 2 hands, 10 throws using your **LEFT** hand, and 10 throws using your **RIGHT** hand.

On the fluid-filled balloon, tie each ligature exactly on the marks provided. Place 3 throws squaring the 3rd throw. Penalty for air knots and leaking vessels.

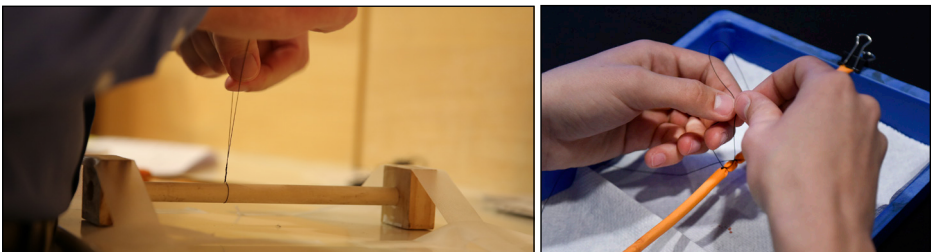


Figure 2.8 – Knot tying on a dowel (left), tying on a fluid-filled balloon (right)

## Station 6 » Fascial Closure

You are asked to close a midline fasciotomy. Please close with 1-cm bites spaced 1 cm apart. You have 6 minutes to complete the task using a running technique.



Figure 2.9 – Intern closing the fascia

## Station 7 » Video Commentary

Verbalize all anatomical structures, techniques, operative equipment and answer questions when prompted. Each accurate fact is worthy of a point.

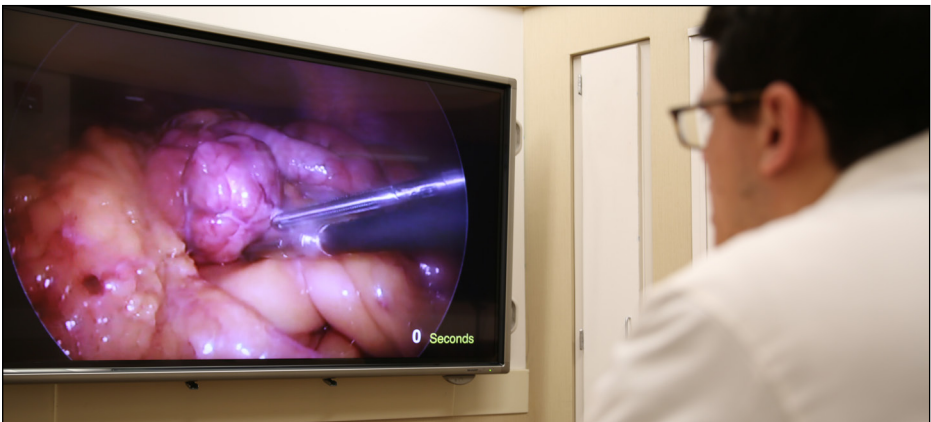


Figure 2.10 – Intern verbalizing facts as the video plays

## Station 8 » ICU Simulation



Figure 2.11 – Intern taking the ICU test

You are about to enter the ICU room of a 57 year-old critically ill surgical patient. He is four days s/p right hemicolectomy with a stapled ileocolic anastomosis. Although he looked OK for several days, last night he became very sick. Fortunately the on-call ICU team took control.

The patient is now intubated, ventilated, sedated, and has been therapeutically paralyzed. The urine and chest tube chambers were emptied one hour ago.

You have **4 minutes** to assess the patient. Following your careful assessments, proceed to the debriefing room.

- Please examine the patient with your EYES, not your HANDS!
- No note cards or scribbling on hands.



Figure 2.12 – ICU Room setup

## Station 9 » FLS - Knot Tying

You have 5 minutes to place a suture through the rubber tube and place a secure knot. Use a laparoscopic grasper & lap needle driver to accurately pass the needle through the black dots (15 sec penalty for missing a dot).

Place 3 subsequent throws to create a secure square knot. Penalties occur for an "air knot" (15 seconds) or avulsing the rubber drain from the Velcro (*FAIL*).

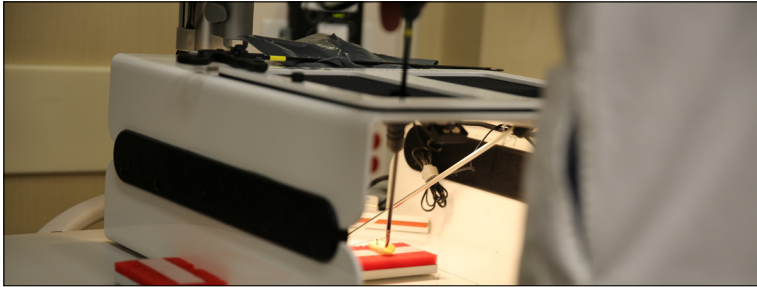


Figure 2.13 – Laparoscopic intracorporeal knot tying

## Station 10 » FES - Colonoscopy

All general surgery residents must pass the fundamentals of endoscopic surgery prior to sitting for their ABS certification. In the station, you are asked to place the colonoscope safely into the cecum via a computer trainer. While speed is important (5 minutes maximum), adequately visualizing the colonic mucosa is important and utilizing < 100 cm of the endoscope is ideal. You must avoid perforating the bowel.



Figure 2.14 – FES colonoscopy test using a computer trainer



# Station 11 » FLS - Peg Transfer & Circle Cut

## ◆ Peg Transfer

In this test you will use graspers to move a total of 6 “discs” from pegs on the left, to pegs on the right, and then back to the left.



Figure 2.15 – Intern moving the discs from the pegs on the left side to the right

1. Left hand grabs disc, lifts it off the peg and transfers it to your right hand. Right hand deposits disc to any peg on the right side. Repeat x5.
2. Right hand grasps disc, lifts it off the peg and transfers it to your left hand. Left hand deposits disc to any peg on the left side. Repeat x5.
3. Timer will record time, number of dropped discs, and number of discs out of the field of vision.

## ◆ Circle Cut

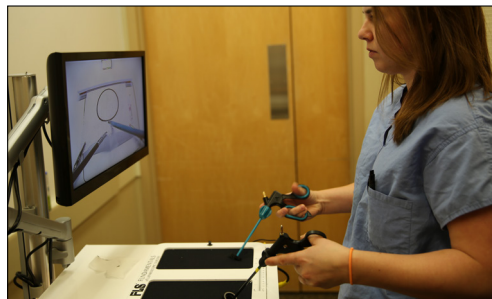


Figure 2.16 – Intern using a laparoscopic grasper & scissor to cut the circle

You have 5 min to cut out the black line circle using a laparoscopic grasper and scissors. Try to cut exactly within the black line (penalties for straying off the line). Do not avulse the gauze from the support mechanism (*FAIL*). You may switch hands and rotate grasper or scissors to facilitate accurate cutting.

## Station 12 » Suturing

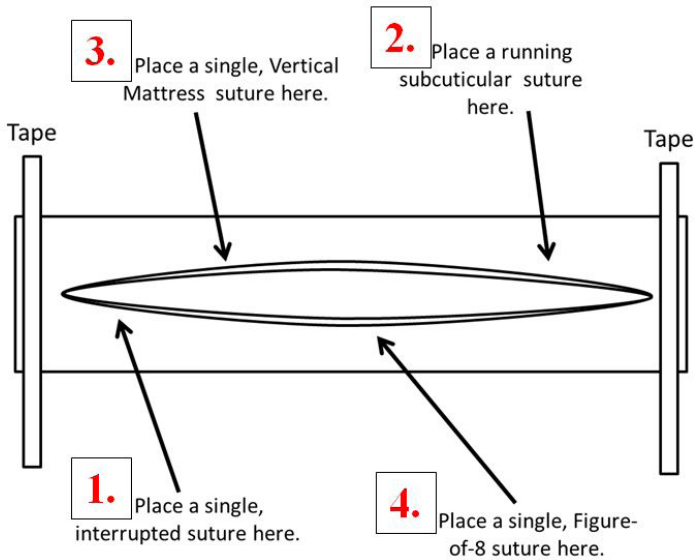


Figure 2.17 – Sketch showing the incision and suture sites

During this station you are expected to safely and accurately place:

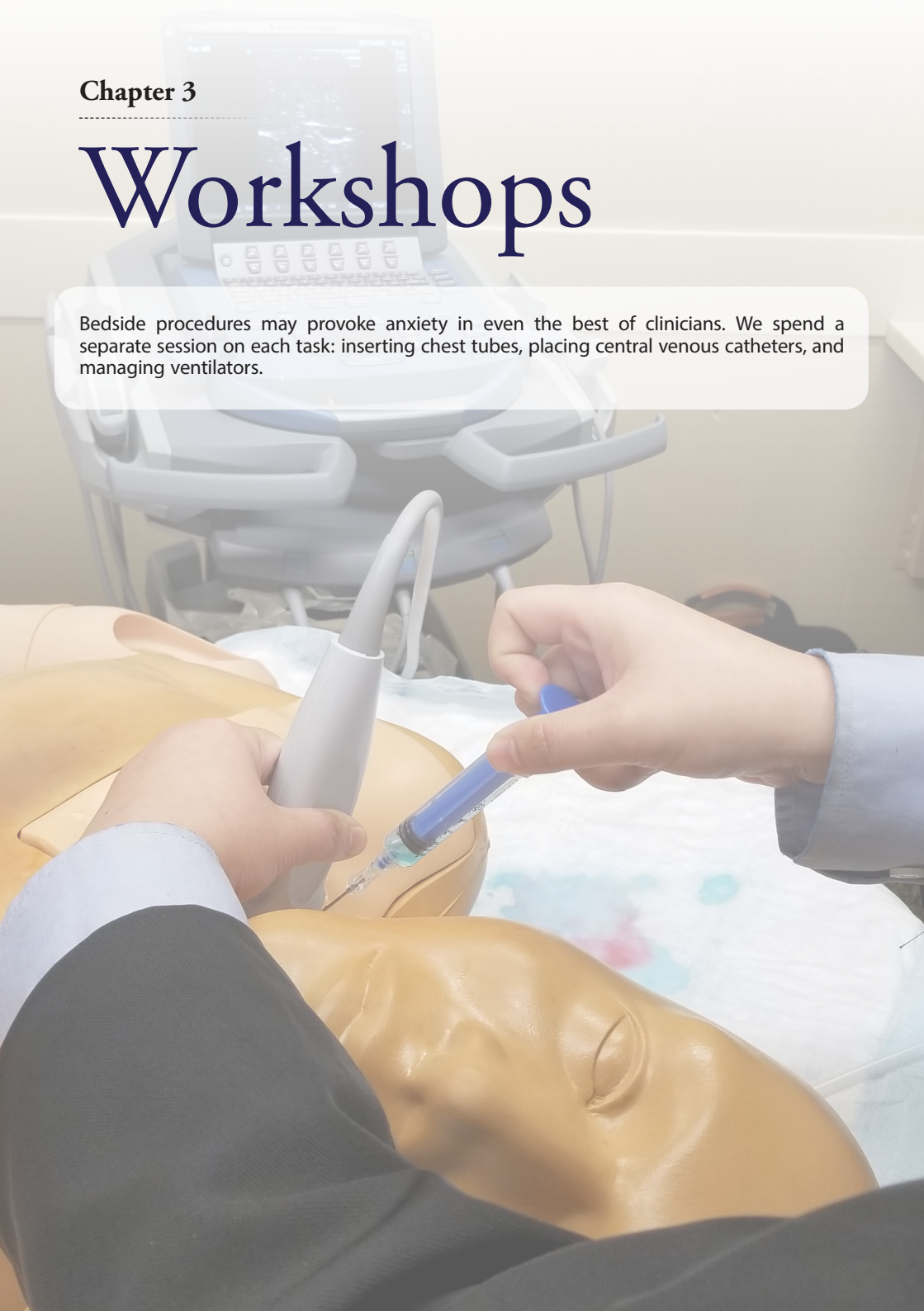
1. Simple interrupted suture
2. Subcuticular skin close
3. Vertical mattress suture
4. Figure-of-8 stitch

Instrument tie your knots (save suture!) securely. Cut tails at < 5 mm.  
Skin approximation and cosmesis are graded.

## Chapter 3

# Workshops

Bedside procedures may provoke anxiety in even the best of clinicians. We spend a separate session on each task: inserting chest tubes, placing central venous catheters, and managing ventilators.





# Tube Thoracostomy

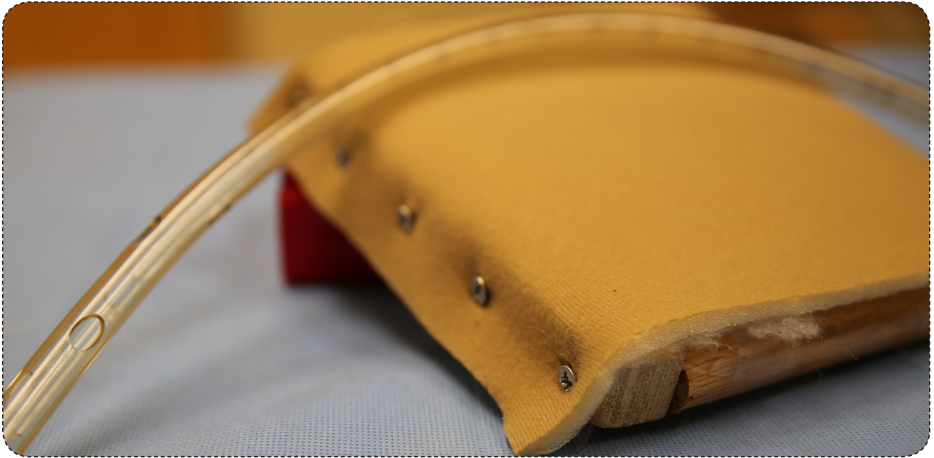


Figure 3.1 – Tube thoracostomy model

Although cadaver and animal models are realistic opportunities to teach chest tube insertion, we offer more repetitions at less than 5% of the cost using lower fidelity models.

After using pre-emptive online learning modules and a short PowerPoint™ presentation with 30 CXR images of both excellent and poorly placed chest tubes, learners spend the next 90 minutes placing and sewing chest tubes into place.

## Overarching Goals

- Understand when needle decompression is needed before inserting a chest tube.
- Understand the indications for placing a chest tube.
- Comprehend the various sizes of chest tubes and relate them to the size of your fingers.
- Be able to connect a chest tube to suction.
- Be comfortable in safely placing chest tubes.

**Steps**

- 1. Palpate and identify the 2nd, 3rd, 4th and 5th intercostal spaces.
- 2. Create a 3-4 cm transverse incision in < 10 seconds.
- 3. Verbalize and perform safe “tunneling” superiorly over at least 1 rib.
- 4. Enter the parietal pleura.
- 5. Touch the lung with your index finger and “sweep”.
- 6. Place a 36 Fr tube into a simulated chest with all drainage holes within the simulated thorax.
- 7. Sew in the tube securely to the skin with < 1 cm displacement.



Figure 3.2 – Tube thoracostomy workshop setup at the simulation center

| Workshop Outline |   |
|------------------|---|
| 9:00             | Introduction   CXR review   |
| 9:30             | Demonstration of chest tube insertion and securement on simulated model |
| 10:00            | Deliberate practice   |
| 11:30            | Debrief   Q&A   |
| 12:00            | Adjourn   |

### ▣ Task(s) to be performed:

Chest tube insertion and securement

### ▣ Stressors | Challenge Questions for Learners

- Chest tube has a moderate continuous air leak. How is that possible?
- What size (French) is your little finger?
- What size (French) is your thumb?
- What size needle (Gauge) is used to decompress a tension pneumothorax?
- What happens if your chest tube falls on the floor?
- Why sew in the chest tube with monofilament suture?
- What happens if blood comes out of your tube?
- What if air leaks around your tube by the skin?
- When should you think about putting in a 2nd tube?
- Where should the tip of your chest tube lie?
- What should you be careful of when you see a broken rib on the CXR?
- How can you be sure you are inserting the chest tube on the correct side?



# Central Line

The Central Venous Catheter Skills workshop includes the use of the central line bundle kit, our aseptic protocol and education as a means of increasing patient safety and reducing infection. Delivery is facilitated through the use of active instruction that includes the use of central line part-task simulation trainers and ultrasound machines in central line placement.



Figure 3.3 – Central line placement into the right IJ vein

## Overarching Goals

- Demonstrate how to prep and drape a patient for a sterile procedure.
- Demonstrate how to consent a patient for insertion of a right sided central venous catheter.
- Gain familiarity with ultrasound of the neck.
- Identify the jugular veins and carotid arteries accurately.
- Complete the assessment/checklist with a 100% pass rate for each of the 19 steps.



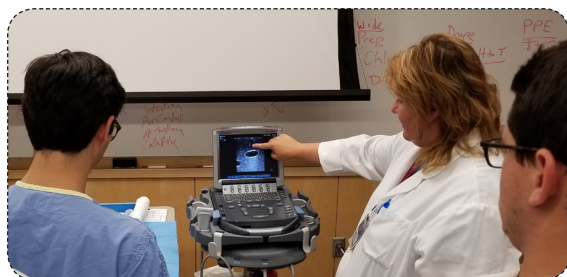
Figure 3.4 – Interns learning how to glove, prep, and drape to safely place a central line

## Objectives

- Identify the carotid and internal jugular vasculature on ultrasound.
- Articulate and demonstrate with the US probe the term “collimation”.
- Complete all 10 steps for placing a needle into the right IJ vein in 30 seconds.

## Workshop Outline

|       |  |
|-------|--|
| 8:30  | Introduction                           |
| 8:45  | Practice Sterile Technique/Draping     |
| 9:15  | Practice Needle and Catheter Insertion |
| 9:45  | Individual Practice & Testing          |
| 11:30 | Debriefing                             |
| 12:00 | Adjourn                                |



**Figure 3.5** – Instructor showing the needle on the ultrasound (top). Instructor briefing the trainees on IJ access (bottom). Trainee attempting to access the IJ vein under US guidance (right).

### ▣ **Task(s) to be performed:**

Complete the steps of central line insertion

### ▣ **Stressors | Challenge Questions for Learners**

- How do you approach a patient with an INR of 2.7?
- What if the patient is in a cervical collar?
- Which way should the US probe be placed?
- Explain the importance of the needle's bevel.
- Define anechoic, hypoechoic, isoechoic, hyperechoic and acoustic shadowing.
- What should happen anytime you think about traversing the skin?
- Where does the IJ vein lie in relation to the CCA?
- How can you guarantee the needle tip lies in the center of the lumen?



# Ventilators



Figure 3.6 – Respiratory therapist teaching trainees on the functions of the ventilator

Led by a board certified critical care surgeon, interns gain hands on experience on managing the ventilator and sensing what some of the settings actually feel like. Utilizing Respiratory Therapists enhances the team centered learning approach.

## Overarching Goals

- List the indications to intubate a patient.
- Cite the accurate location of the end of endotracheal tubes.
- Gain hands on experience with ventilators.
- Understand normal human physiology and ventilator requirements.
- Identify the various settings/modes of ventilator assisted respiration.

## Workshop Outline

|       |   |
|-------|---|
| 9:00  | Introduction   Respiratory failure lecture          |
| 9:30  | Basic ventilator settings and modes                 |
| 10:00 | Experience breathing on the ventilator              |
| 10:30 | Complete CXR interpretation examination             |
| 11:00 | Analyze blood gases & subsequent patient management |
| 11:30 | Review CXR examination                              |
| 12:00 | Adjourn   |

### ▣ Task(s) to be performed:

1. Learn the basic ventilator settings
2. Analyze blood gases & patient management
3. Experience breathing on the ventilator



Figure 3.7 – Intern breathing on the ventilator



## Objectives

- Utilize the A-B-C-D-E mnemonic to read a chest radiograph and state 10 facts.
- Demonstrate the steps of intubation in less than 60 seconds.
- Define the 3 ventilation settings.
- Interpret 2 arterial blood gases accurately.
- Feel and sense what different ventilatory settings feel like.



## Chapter 4

# Simulation Sessions

Simulated learning technologies are here to stay. We have an obligation to use them efficiently and effectively in supporting our surgical trainees' educational needs.

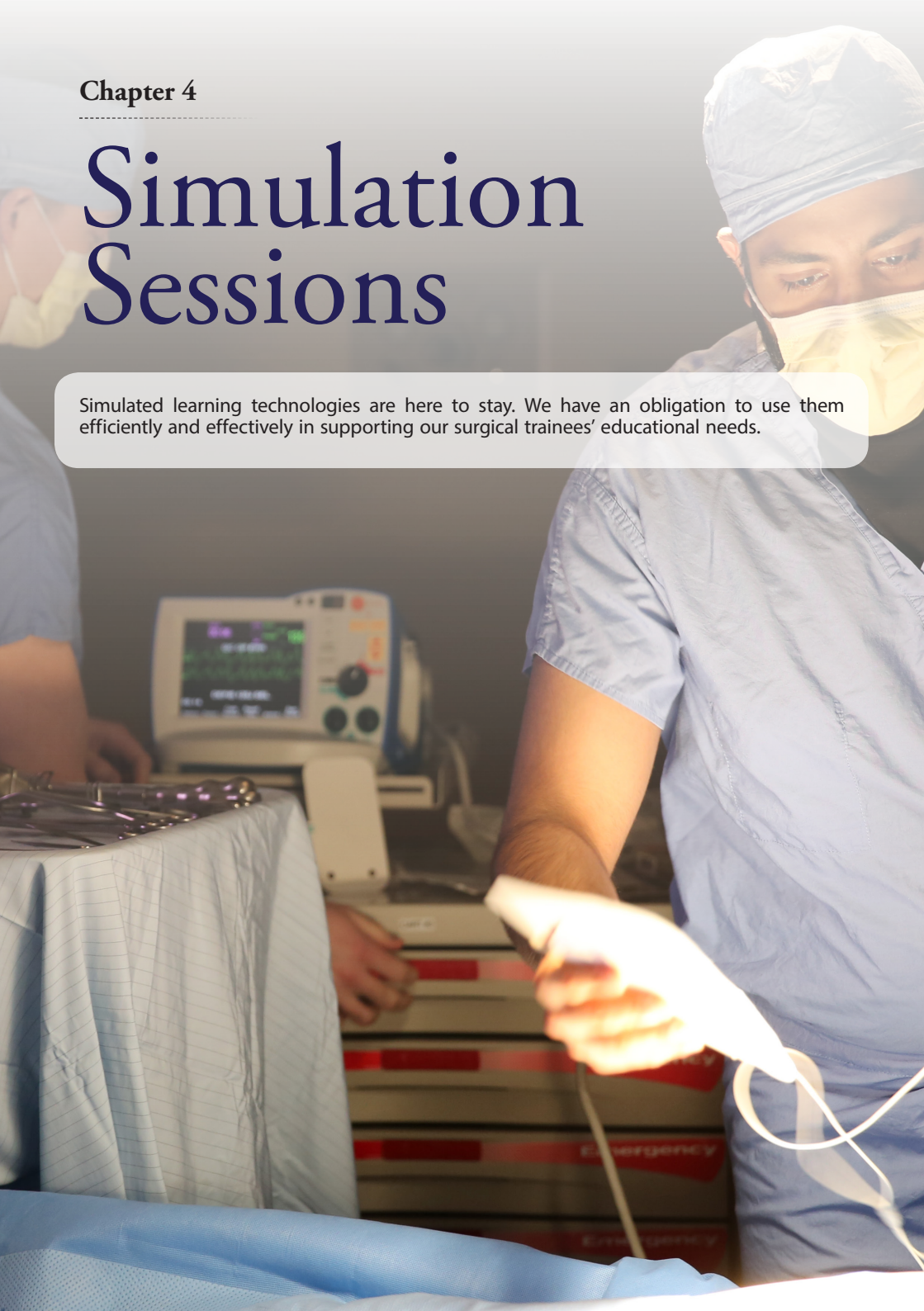




Figure 4.1 – Overview and pre-session briefing in the conference room

Following the Surgical Boot Camp, the Surgical Olympics, the Central Line Workshop, the Chest Tube Workshop, and the hands on session on Ventilators, we begin in earnest our Friday Morning Surgical Intern curriculum. Mayo surgical interns are freed from clinical responsibilities from 9:00 a.m. to noon every Friday morning. We consistently meet in our conference room, describe the morning activities and split up into smaller groups. Each group typically rotates through operative scenarios, academic exercises, repetitions on low fidelity models, and through a room where previously learned skills are covered. Debriefing, taking a quiz, writing in personal books (pearls learned, mistakes made, images drawn, etc.), and answering questions from the entire group finishes off the morning. Feedback from learners is asked for informally every session and formally every four sessions. The curriculum changes each year based on this feedback.

The 13<sup>th</sup> year (2018-2019) of this surgical intern curriculum remains imperfect, but our current learners continue to meet or outperform previous trainees year by year. We credit this improvement to 1) more hands on repetitions, 2) showing learners the checklists and scoring criteria, 3) showing past performance (successes and failures) of trainees, 4) offering online resources that educate on surgical skills and knowledge, and 5) emphasizing to interns how improving on performance now carries over to clinical work, clinical rotations, career aspirations, and most importantly, patient outcomes.

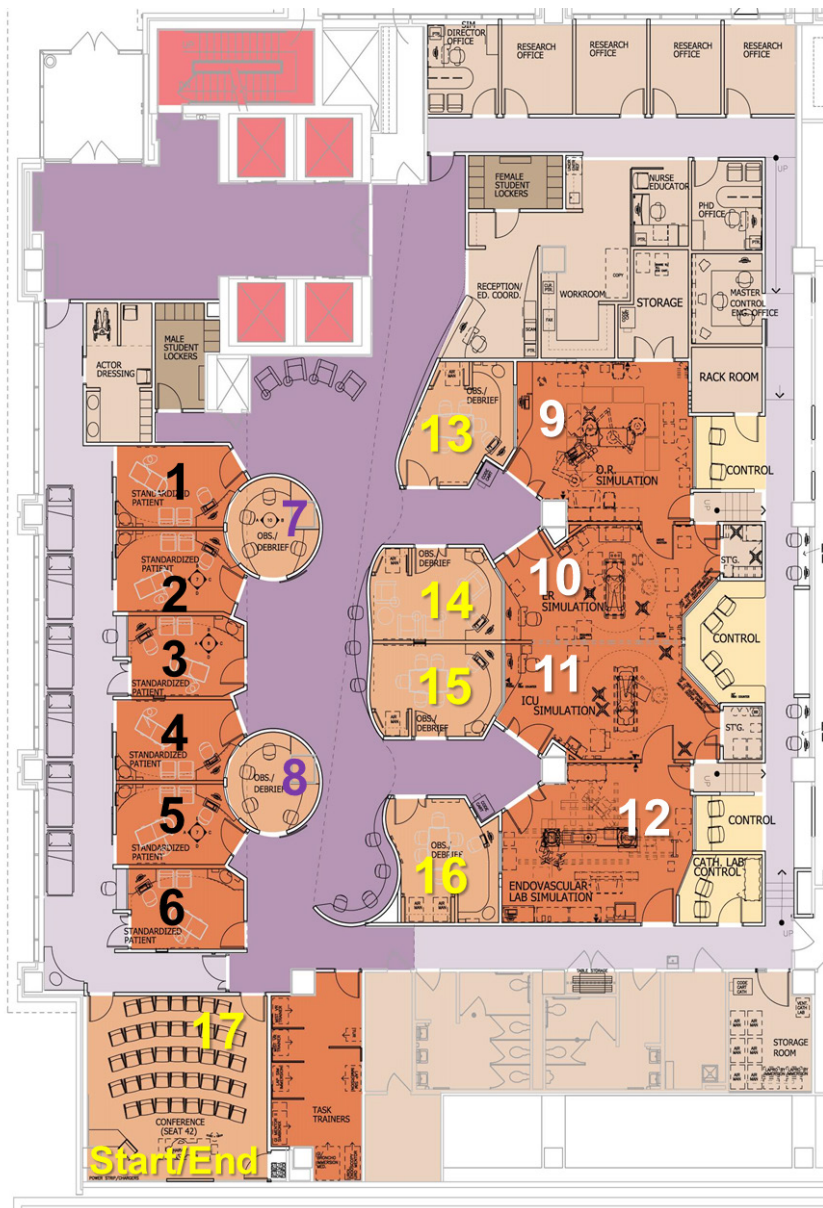


Figure 4.2 – The Mayo Clinic Multidisciplinary Simulation Center. 35 of 40 Friday morning surgical intern teaching sessions occur here. Sessions start and end in the conference room (17). The Operating Room (9), Emergency Room (10), and smaller clinical exam rooms (1-6) are consistently utilized to divide up learners and offer added repetitions.



Our Surgical Simulation Education Team has utilized two (A vs. B) broadly different types of 3-hour sessions for our learners based on subjects and group dynamics.

**Outline A:** 1 group; 3 Scenarios, 3 Debriefings, and 3 Skill Sessions (all learners together)

**Outline B:** 3 groups & 3 Rotations: OR > Skills > Academic (learners in 3 separate groups)

We typically use one of the two approaches on Friday mornings. Each year based on our own number of learners and staff support, we do not hesitate to utilize or flex to **Outline A** or **B** to facilitate the best educational opportunities for our trainees. A shortage of staff with lesser training numbers is optimal for **Outline A**. If we have 3 or more staff ready to teach invariably means **Outline B** will be utilized.

Whenever possible we prefer sessions that offer the most repetitions for each of our learners - invariably we prefer Outline B; smaller groups offering more repetitions.



Figure 4.3 – Practicing basic skills on low fidelity models

Each of our subject sessions (surgery 101, hernia, breast, etc.) is broken down in this book in a consistent format:

- |                     |                          |
|---------------------|--------------------------|
| – Overarching goals | – Scenarios              |
| – Introduction      | – Tasks to be performed  |
| – Objectives        | – Stressors/Challenge Qs |
| – Supplies needed   | – Topics to cover        |
| – Models used       | – Pearls                 |

# Outline Example

## ► OUTLINE A

(1 group; 3 Scenarios, 3 Debriefings, and 3 Skill Sessions)



Figure 4.4 – Instructor debriefing after an ACLS scenario

### ◎ Plan

- 15 minutes in Sim OR – Learners fix inguinal hernia (model)
- 15 minutes debrief / Q&A
- 20 minutes – Group practices sewing in mesh on simple models

### ◎ Plan

- 15 minutes in Sim OR – Learners fix umbilical hernia
- 15 minutes debrief / Q&A
- 20 minutes – Group practices sewing primary & mesh repairs for UH

### ◎ Plan

- 15 minutes in Sim OR – Learners fix ventral hernia
- 15 minutes debrief / Q&A
- 20 minutes – Group practices sewing for Stoppa repair

## ► **OUTLINE B** (3 groups & 3 Rotations: OR > Skills > Academic)



Figure 4.5 – Teamwork in a simulated OR (left), instructor explaining the steps to a laparoscopic adrenalectomy (right)

### ◎ **Sim OR (30-40 minutes)**

- Group fixes inguinal hernia on 1-3 models
- Ongoing Q&A
- Challenge questions

### ◎ **Academic Room (30-40 minutes)**

- Game (Jeopardy, \$25,000 Pyramid, Pictionary)
- Q&A on Hernia
- Some time for solo learner to "demo" in front of peers

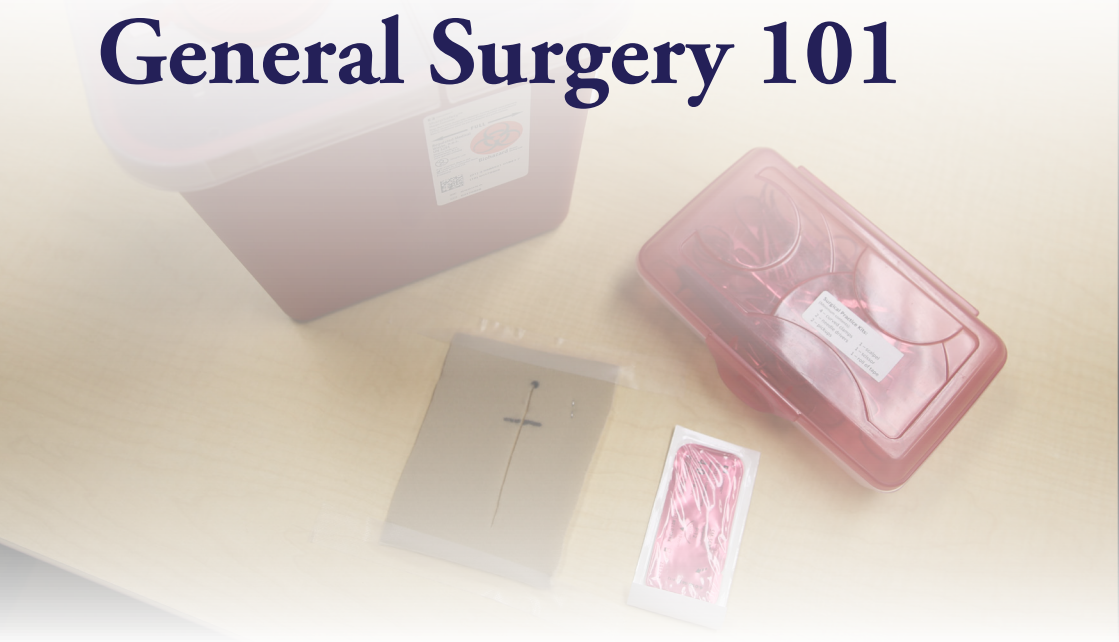
### ◎ **Conference Room (30-40 minutes)**

- Practice session
- Simple models
- Numerous repetitions on IH, UH, VH
- Staff tutelage in smaller group

### ◎ **Wrap Up / Debrief (10-20 minutes)**

- Objectives
- Q&A
- Goals
- Mistakes made

# General Surgery 101



## Overarching Goals

- Introduce learners to multiple suture types.
- Provide instruction in 1 & 2-handed knot tying.
- Introduce learners to 1<sup>st</sup> assisting.
- Introduce learners to basic surgical techniques of clamping, cutting, tying, and sewing.



This session of our surgical simulation curriculum aims to offer education and experience that was clearly just tested in our Surgical Olympics. Beyond repetition and practice with cutting, sewing, and tying suture, we introduce our new interns to surgical skills involving dividing small bowel mesentery, closing fascia, and other operative skills.

### **§ Objectives**

- Tie 30 secure knots (10 L, 10 R, 10 2-handed) in < 90 seconds
- Accurately perform ligation in continuity vs. discontinuity
- Perform ligation in continuity as surgeon AND as assistant
- Demonstrate effective and cosmetic skin closure for a 5 cm incision (performed in < 3 minutes)

### **§ Supplies (4 learners)**

|   |                    |   |                      |
|---|--------------------|---|----------------------|
| 4 | Tissue Forceps     | 4 | Needle Drivers       |
| 4 | Scalpels           | 4 | Curved Clamps        |
| 4 | Scissors           | 1 | Roll of Tape         |
| 4 | 3-0 Silk ligatures | 4 | 3-0 Vicryl ligatures |

### **§ Models Used**

- Skin Closure — p.120 ➤
- Balloon Knot Tying — p.121 ➤
- Small Bowel with Mesenteric Vessels — p.130 ➤

## Scenario: Mesentery Ligation

63 year-old male with a history of vomiting, abdominal pain and a CT scan with evidence of a likely complete Small Bowel Obstruction (SBO). The patient undergoes a laparotomy showing an obstructing mass in the jejunum. Segmental resection is planned.



Figure 4.6 – Axial CT scan illustrating SB Obstruction

### ▣ Task(s) to be performed:

The jejunal mesentery is to be ligated (with ties) & divided by all learners rotating into both junior surgeon and first assistant roles.

### ▣ Stressors | Challenge Questions for Learners

- What is the DDx for a jejunal mass?
- What is the management of a partial versus complete small bowel obstruction?
- What are the 5 keys to a safe bowel anastomosis?
- What dangers are there in closing a mesenteric defect?
- What dangers are there in NOT closing a mesenteric defect?
- What is a “tie on a passer”?
- Will you move the clamp when a surgeon is tying underneath it?
- What does “flashing” mean?
- What mistakes can surgeon and assistant make when teaming together to tie off the mesenteric vessels?

### ▣ Topics to cover (skill session & debrief):

- Sutures & ligatures
- 1-handed vs. 2-handed ties
- Risks of ischemia to the anastomosis
- Clamp, clamp, cut, tie, tie (tie in discontinuity)
- Ligation in continuity
- Small bowel pathology
- Surgical options, judgment, and insight
- Radiologic and pathologic findings of importance

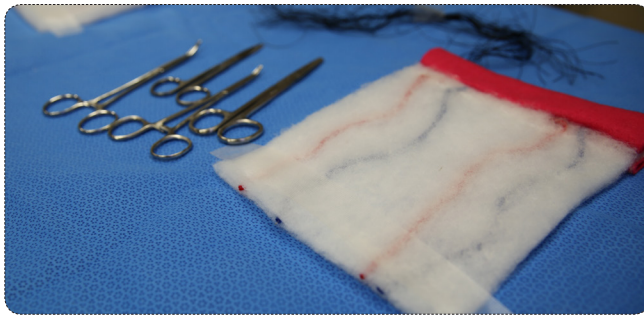
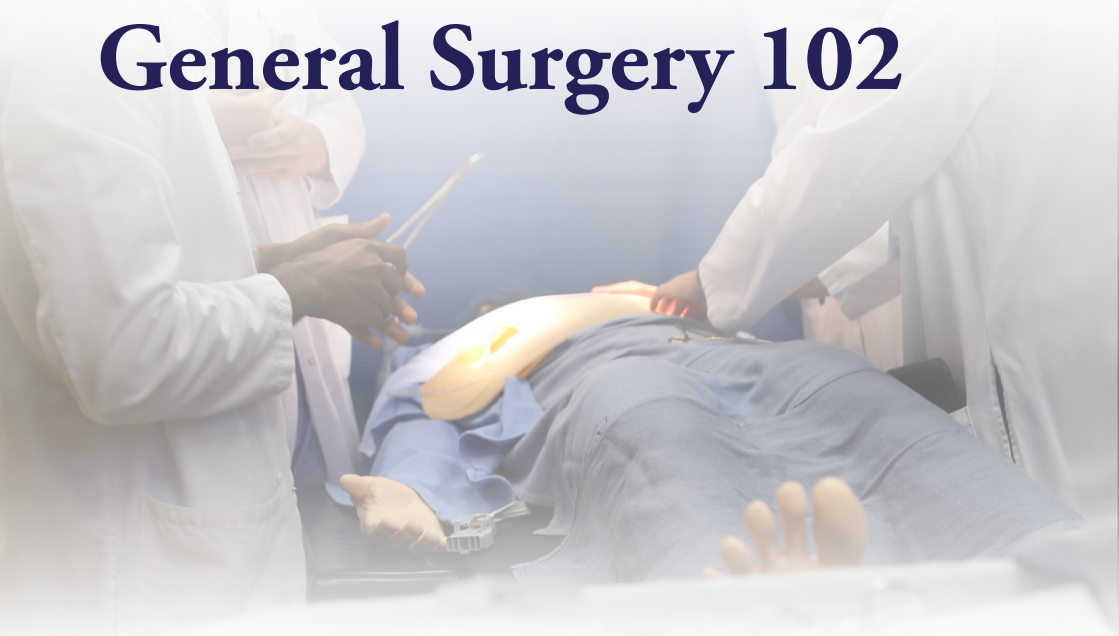


Figure 4.7 – Ligation model showing the small bowel with mesentery

### ▣ Pearls

- Support mesentery and dissect vessels carefully to avoid shearing and tearing.
- Clamp vessels “just across” with mirrored tips.
- Tie with “finesse” - approximation not strangulation.
- Line of sight: setting up the surgeon & assistant; do not block the vision of others and plan ahead by predicting where the scissors will enter the surgical field.
- Careful of excess tension – do not pull up on ligatures.
- Cut the ‘bridge’ of the vessel leaving a cuff on each side of the tie, cutting sutures last - use one cut to transect vessels.
- Trim ligatures based on type of suture: Shorter tails (2-4 mm) for braided suture vs. longer tails (5-10 mm) for monofilament.
- Clamp placement, passing ties, ligation, and other facets of surgical technique may vary on the tissue quality, operative exposure, left or right-handed surgeons, size of the vessel or the amount of fatty tissue. Recognize variations and act accordingly.

# General Surgery 102



## Overarching Goals

- Introduce learners to effective drain placement.
- Introduce proper wound closure techniques.
- Add on to learners' set of basic surgical techniques and skills.

This session aims to introduce our interns to surgical skills involving mastectomy drain insertion and securement, mastectomy wound closure, and other operative skills.

## **§ Objectives**

- Securely tie and stabilize drains in less than 2 minutes.
- Demonstrate how to close subcuticular and skin wounds securely and cosmetically in less than 10 minutes.
- Accurately build the anatomy of the skin, subQ tissues, abdominal and chest walls.

## **§ Supplies (4 learners)**

|   |  |   |                    |
|---|--|---|--------------------|
| 4 | Tissue Forceps                           | 4 | Needle Drivers     |
| 4 | Scalpels                                 | 4 | Curved Clamps      |
| 4 | Scissors                                 | 1 | Roll of Tape       |
| 4 | 3-0 Silk sutures                         | 4 | 3-0 Vicryl sutures |
| 4 | 2-0 Monofilament (Nylon/Prolene) sutures |   |                    |

## **§ Models**

- **Mastectomy Drain Placement — p.127 ➤**
- **Skin Closure — p.120 ➤**
- **Abdominal Anatomy — p.119 ➤**

## Scenario: Mastectomy Drain Securement and Wound Closure

60 year-old female undergoes bilateral mastectomy for Invasive Ductal Cancer on the right side and DCIS on the left.

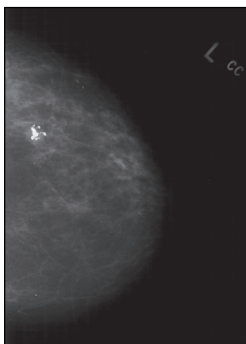


Figure 4.8 – Crainal-Caudal (CC) mammogram with biopsy proven DCIS of the left breast

### Task(s) to be performed:

1. Drains need to be inserted.
2. Wounds need to be closed. Six trainees will work together, as Jr. surgeon (2), 1st assistant (2) and scrub nurses (2) to insert drains bilaterally and to close the mastectomy wounds.

### Stressors | Challenge Questions for Learners

- MD calling to discuss a mammogram (project to learners); does the patient require observation, biopsy or neoadjuvant therapy?
- What is a modified radical mastectomy?
- What is breast conservation therapy?
- What is an appropriate age to begin mammography screening?
- What is peau d'orange ?
- What is useful about a cutting needle?
- Why might you place 2 drains within a mastectomy wound?
- What does the term “mattressing” mean? Quilting?
- How do you strip a drain? What does the patient need to know?

### ▣ Topics to cover (skill session & debrief):

- Selecting, placing, and securing drains
- Mastectomy closure
- Running vs. interrupted closure
- Buried knots
- Number of layers to close
- Dog ears: V-Y vs. V flaps
- Flap ischemia



Figure 4.9 – Bilateral mastectomy model (left), trainees working on closing the wound and placing drain (right)

### ▣ Pearls

- Cut the outer end of the drainage tube at a 45° angle.
- Pull the drainage tube from inside of wound to outside.
- Drain incision should be caudal & on the lateral line of the mastectomy wound - away from the flap.
- Make sure that the last drain hole is inside the wound by at least 3 cm.
- Secure the tube to the skin with a 2-0 Prolene or Nylon - monofilament suture - causes less skin irritation.
- First knot on the skin when securing the drain should be an air knot - leave a 1 cm loop.
- Close the subcutaneous tissue with buried knots; preference for interrupted vertical stitches. Close the skin with 3-0 or 4-0 absorbable suture in a running subcuticular fashion with a cutting needle. Ideally monofilament suture.



# Hernia



## Overarching Goals

- A basic understanding of groin anatomy is the key to successful hernia repair.
- Introduce learners to the types of hernias and their surgical management.
- Learners must be able to verbalize the meaning of tension-free repairs.
- Explain why mesh is useful in hernia repairs.
- Explain the downsides of mesh repairs.

This session is used to understand the basics of umbilical, incisional and inguinal hernia anatomy, symptoms, signs, operative repair, and post-op care for patients.

## **§ Objectives**

- Identify 25 different anatomical structures of the groin.
- Describe a tension free repair.
- Provide at least 2 reasons each for why polypropylene mesh vs. Gore-tex™ vs. 1° repairs might be useful.
- Accurately name >10 surgical instruments and 6 different kinds of suture.
- Articulate at least 4 reasons for post-op “inguinodynia”.
- Suggest situations in which either laparoscopic or open repairs should not be utilized.

## **§ Supplies (4 learners)**

|   |                                       |   |                   |
|---|---------------------------------------|---|-------------------|
| 4 | Tissue Forceps                        | 4 | Needle Drivers    |
| 4 | Scalpels                              | 4 | Curved Clamps     |
| 4 | Scissors                              | 1 | Roll of Tape      |
| 8 | 3-0 Silk suture                       | 4 | 3-0 Vicryl suture |
| 4 | 0-Monofilament (e.g., Prolene) suture |   |                   |

## **§ Models**

- **Open Inguinal Hernia Repair — p.135 ➤**
- **Groin Anatomy — p.119 ➤**

## Scenario: Open Inguinal Hernia

55 year-old male who has groin pain with a bulge. The plan is to do an open inguinal hernia repair with mesh.



Figure 4.10 – Axial CT image showing a right inguinal hernia with bowel contents

### ▣ Task(s) to be performed:

1. Dissect the hernia sac.
2. Place the sac intra-abdominally or ligate it highly.
3. Suture the mesh in place as Jr. surgeon, 1<sup>st</sup> assistant and 2<sup>nd</sup> assistant.

### ▣ Stressors | Challenge Questions for Learners

- The ER calls with a patient with a bulge in his groin. “The skin is red and he has pain with palpation. He is vomiting. What should we do?”
- Which mesh is the best?
- Should you close the Scarpa fascia?
- What sensory nerves could be injured with inguinal hernia repair?
- When should a Foley catheter be used?
- Where are the iliac/femoral vessels?
- Where is the Hesselbach triangle?
- What are the differences between direct & indirect inguinal hernias?
- How do you prove the patient does not have a femoral hernia?
- Who gets incarcerated or strangulated hernias?

### ▣ Topics to cover (skill session & debrief):

- Instructor will discuss the different types of open inguinal hernia repairs. Bassini, McVay, Lichtenstein, etc.
- Discuss the anatomy of the inguinal region
- Discuss nuances of the Lichtenstein repair
- Learners use instruments to cut mesh, repair the hernia, & close the wound
- Learners will have simplified models available to practice groin dissection and mesh placement

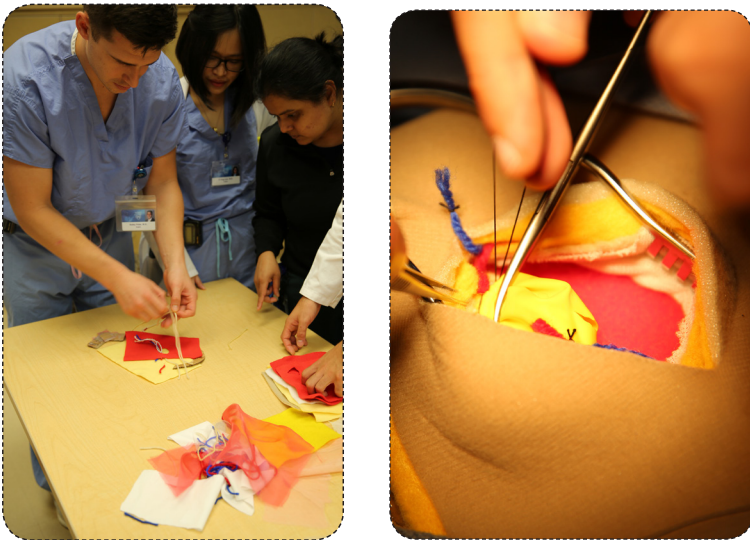


Figure 4.11 – Trainees building the anatomy of the groin region (left), tying a vessel on an open inguinal hernia repair model (right)

### ▣ Pearls

- Anatomy of the nerves in the inguinal region.
- Tension-free mesh repair is superior to 1° repair.
- Cut the mesh appropriately - avoid extremes of laxity or tension.
- Think about the size of the new internal ring - snug to cord.
- Operating on the correct side.

# Anastomosis



## Overarching Goals

- Review anatomy (stomach, SB, colon, bile ducts).
- Learn the indications to perform a bowel anastomosis and the contraindications for resection.
- Introduce learners to the different types and methods for bowel anastomosis.

This session aims to give our trainees “hands-on” practice on small bowel anastomosis. The operating room vignette crystallizes the important surgical techniques and benefits of surgical insight, and the skills room allows learners multiple repetitions.

## **§ Objectives**

- Identify blood supply of the bowel
- Complete a hand-sewn anastomosis by performing interrupted Lembert sutures for the outer back-wall, running the posterior and anterior inner layers followed by an anterior outer layer of interrupted Lembert sutures
- Name the 5 keys to a safe anastomosis
- Articulate how to perform a Mayo, 2-layer, hand-sewn anastomosis

## **§ Supplies (4 learners)**

|    |                  |   |                   |
|----|------------------|---|-------------------|
| 4  | Tissue Forceps   | 4 | Needle Drivers    |
| 4  | Scalpels         | 4 | Curved Clamps     |
| 4  | Scissors         | 1 | Roll of Tape      |
| 4  | Mosquito forceps | 2 | Bowel clamps      |
| 12 | 3-0 Silk suture  | 4 | 3-0 Vicryl suture |

## **§ Models**

- **Small Bowel Anastomosis — p.129 ➤**
- **Abdominal Anatomy — p.119 ➤**



**Scenario:**  
**Side-to-Side Hand-Sewn Small Bowel Anastomosis**

A 65 year-old male has a history of nausea, vomiting, abdominal pain and distention for 24 hours. He is ill and severely distressed. Patient was brought to the OR for exploration.



Figure 4.12 – Axial CT image showing small bowel obstruction

▣ **Task(s) to be performed:** Bowel resection needs to be performed with a primary side to side anastomosis.

▣ **Stressors | Challenge Questions for Learners**

- What are the causes of a small bowel obstruction?
- When do you choose to resect vs. bypass vs. close?
- What is the best way to lyse adhesions?
- What are the 5 key factors to create a safe anastomosis?
- Can you decompress the bowel safely? How?
- What good are non-crushing bowel clamps?
- What is the Lembert stitch?
- How do you avoid “sewing in the backwall”?
- What is a stricturoplasty?

### ▣ Topics to cover (skill session & debrief):

- 5 keys to a good anastomosis:
  - Good blood supply
  - No tension
  - Patency
  - No distal obstruction
  - Air tight
- Assessment of bowel status, extent of the resection.
- Learners will have simplified models for performing hand-sewn, side to side, primary bowel anastomoses.
- Educators will guide learners through steps of the procedure and help them to understand key concepts of a side to side, gastrointestinal anastomosis.



Figure 4.13 – Trainees working in pairs to perform a small bowel anastomosis

### ▣ Pearls

- Start with the outer layer of the anastomosis on the back wall.
- Seromuscular (outer) layer, use permanent suture (3-0 silk).
- Full thickness (inner) layer, use 3-0 absorbable suture.
- Outer layer = interrupted (Lembert), inner layer = running.
- Do not back-wall while suturing the front wall.
- Insure patency.
- Increased tension = Increased chance of failure and leak.
- Lock the running back wall suture at the apex to avoid synching it closed while running the anterior wall.

# Breast



## Overarching Goals

- Understand the basics of treating breast cancer effectively in a multidisciplinary fashion.
- Review the role for SLN mapping & biopsy.
- Review various surgical options for breast cancer treatment.

Interns will be educated on breast and axillary anatomy, breast pathology, diagnosis, imaging, surgical technique, and post-operative complications.

### **§ Objectives**

- Place sutures < 1 cm apart to close a mastectomy wound.
- Place interrupted sutures in a “buried” fashion.
- Verbalize 5 facts regarding a wire localization mammogram.
- Accurately make an incision for a lumpectomy.
- Accurately perform a lumpectomy.
- Label/mark a specimen with 3 stitches (short length tail superior side, long length tail lateral side, and medium length tail medial side).

### **§ Supplies (4 learners)**

|    |                  |   |                    |
|----|------------------|---|--------------------|
| 4  | Tissue Forceps   | 4 | Needle Drivers     |
| 4  | Scalpels         | 4 | Curved Clamps      |
| 4  | Scissors         | 1 | Roll of Tape       |
| 12 | 3-0 Silk sutures | 4 | 3-0 Vicryl sutures |

### **§ Models**

- **Bilateral Mastectomy Closure — p.126 ➤**
- **Mastectomy Drain Placement — p.127 ➤**
- **Breast Wire Localization — p.128 ➤**

## Scenario: Left Breast Lumpectomy

A 45 year-old female with a positive biopsy of the left breast for Infiltrating Ductal Cancer. Lymphoscintigraphy and pre-op wire localization has been performed. The patient has consented for BCT, but not for mastectomy.

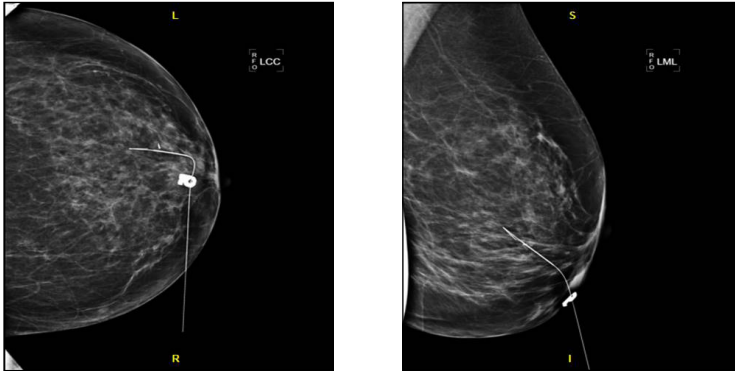


Figure 4.14 – Mammogram of the left breast with a wire placed

### Task(s) to be performed:

1. Place an incision, excise the region and mark the breast specimen.
2. An axillary SLN biopsy will then be performed.

### Stressors | Challenge Questions for Learners

- Radiology calls with next case - wire not close, how will you proceed?
- A Surgical colleague asks you to view breast images (CT, mammogram). What will you tell her?
- Medical Oncology calls about a patient with recurrent tumor. What would you like to ask?
- What is a sufficient margin around cancer?
- What is TNM?
- What happens if you can never obtain a negative margin?
- What does XRT do to cosmesis? Breast size?
- What will you do if the specimen mammogram shows no clip?

### ▣ Topics to cover (skill session & debrief):

- Margins of resection
- SLN biopsy: pros and cons, techniques and pit falls
- Obtaining patient consent
- Wire localizations and radioactive seeds
- Cosmesis
- Incisions



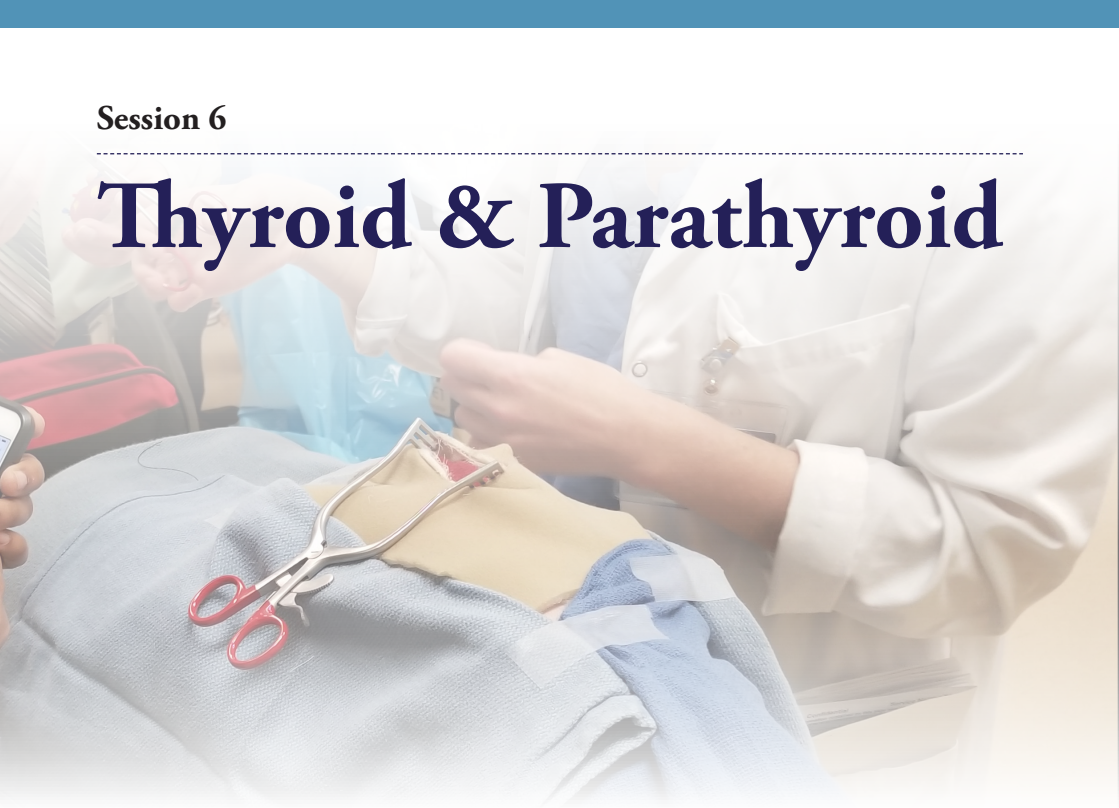
Figure 4.15 – Breast wire-localization model that is used on this session with wire and lump excised (left), model still intact (right)

### ▣ Pearls

- Radial vs. curvilinear scars.
- Wire measures: 1 cm J hook, 2 cm thick portion. Plan ahead.
- Spheres vs. pyramids; specimen shapes.
- Margins: cosmesis vs. cancer.
- Level 1, 2, 3 axillary nodes.
- Palpate axilla. What is a SLN? What is PPV?
- SM/SLN vs. BCT: pros and cons, survival and recurrence.



# Thyroid & Parathyroid



## Overarching Goals

- Introduce interns to thyroid and parathyroid procedures.
- Describe the anatomy of the neck.
- Understand the perioperative management of endocrine surgery patients.

This session of our surgical curriculum aims to offer education and experience on common endocrine surgical procedures. Beyond repetition and practice with cutting, sewing, and tying suture, we aim to introduce our interns to surgical skills revolving around thyroidectomy and parathyroidectomy.

## **§ Objectives**

- Name and be able to treat 3 key post thyroidectomy complications (RLN injury, Hematoma, Hypocalcemia)
- Verbalize the steps to fully expose the thyroid gland
- Describe treatment for thyroid malignancies (PTC, MTC, follicular, anaplastic lymphoma, mets.)
- Explain where the tubercle of Zuckerkandl, ligament of Berry, RLN, and 4 parathyroids are located
- Explain when PTH levels confirm operative cure
- Explain what the 85-12-2-1 ratio means in the diagnosis of 1° HPT

## **§ Supplies (4 learners)**

|    |                          |    |                      |
|----|--------------------------|----|----------------------|
| 4  | Tissue Forceps           | 4  | Needle Drivers       |
| 4  | Scalpels                 | 4  | Curved Clamps        |
| 4  | Scissors                 | 1  | Roll of Tape         |
| 2  | Self-retaining Retractor | 2+ | Senn Retractors      |
| 12 | 3-0 Silk ligatures       | 4  | 3-0 Vicryl ligatures |

## **§ Models**

- **Thyroidectomy — p.140 ➤**
- **Neck Anatomy — p.119 ➤**

## Scenario: Thyroid Lobectomy

32 year-old patient, diagnosed with Papillary Thyroid Carcinoma (PTC) and asymptomatic hypercalcemia. Labs: calcium (11.0 mg/dl), PTH (115 pg/ml) and TSH (1.2 mIU/L). Imaging: US - right thyroid nodule 4 cm and sestamibi scan - does not show any abnormalities.

Patient has a positive biopsy for PTC. A right lobectomy has been performed.

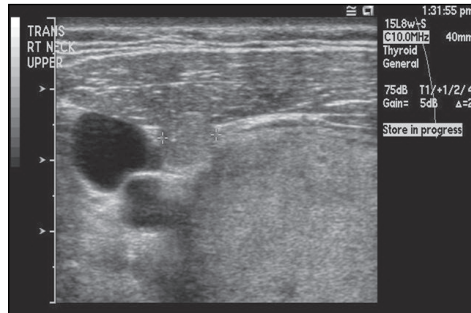


Figure 4.16 – Neck ultrasound with right thyroid nodule

❏ **Task(s) to be performed:** Left thyroid lobectomy

### ❏ Stressors | Challenge Questions for Learners

- What is the most common location for the inferior parathyroid gland?
- What is the importance of intra-operative PTH levels?
- Pathology calls back with right lobectomy results: 4.3 cm PTC grade 1 extending to capsule. 2 of 7 lymph nodes are positive for PTC and 2 normal parathyroid glands were found. What now?
- What is the MACIS scoring system?
- How often is PTC multicentric?
- How do you transplant a parathyroid gland?
- Where is the inferior thyroid artery located?
- What are the trauma zones of the neck?
- What are the lymph node regions of the neck?
- What is the tubercle of Zuckerkandl? Ligament of Berry?

### ▣ Topics to cover (skill session & debrief):

- Describe the proper techniques and exposure for cervical exploration
- Discuss intraoperative PTH level utilization
- Discussion of different causes of hyperparathyroidism
- PTC and MACIS scoring system to predict 20 year survival
- RLN injury - what does that mean?
- What can be done to avoid a cervical hematoma?

### ▣ Pearls

- The RLN is found in the tracheoesophageal groove.
- Parathyroid transplants will function in several weeks.
- The inferior thyroid artery makes a “M” course along the thyroid.
- The tubercle of Zuckerkandl is the anatomical location (embryologic bud) of the thyroid where the genu of the RLN will be found.
- Inferior parathyroids may be found in the thymus, superior parathyroids lie near the genu of the RLN. Superior adenomas may lie in the TE groove.
- Patients with PTC do very well even with lymph node mets.
- Ectopic parathyroid glands are uncommon but occur in the mediastinum, carotid sheath, near the base of the tongue and inside the thyroid gland.
- Most missed parathyroid adenomas are usually in their normal location.



Figure 4.17 – Thyroidectomy model with thyroid detached from the base

# HPB Surgery



## Overarching Goals

- Review the anatomy of the HPB system and common variations.
- Provide instructions in performing anastomoses.
- Introduce learners to pancreatic pathology that requires surgical intervention.

Give PGY-1 residents “hands-on” practice on the basics of HPB surgery. Performing a portion of a Whipple operation is a “big deal” for interns - whether live or simulated.

## **§ Objectives**

- Name the 5 main structures of the biliary tree
- Name 3 keys to a safe PJ
- Name 5 signs of a post-op PJ leak
- Name at least 2 factors that differentiate standard Whipple vs. pyloric preserving Whipple
- Build the 5 regions of the pancreas with a felt model incorporating the SMV, SMA, PV and splenic vein

## **§ Supplies (4 learners)**

|    |                  |   |                       |
|----|------------------|---|-----------------------|
| 4  | Tissue Forceps   | 4 | Needle Drivers        |
| 4  | Scalpels         | 4 | Curved Clamps         |
| 4  | Scissors         | 1 | Roll of Tape          |
| 4  | Bands/Retractors | 4 | Richardson Retractors |
| 12 | 3-0 Silk sutures | 4 | 3-0 Vicryl sutures    |

## **§ Models**

- **Pancreatojejunostomy — p.132 ➤**
- **Hepatojejunostomy — p.132 ➤**



## Scenario: Whipple/Pancreatojejunostomy

65 year-old male with a two week history of jaundice. He has no abdominal pain. Patient has a 4 cm adenocarcinoma in the head of the pancreas and a pancreatoduodenectomy has been performed.

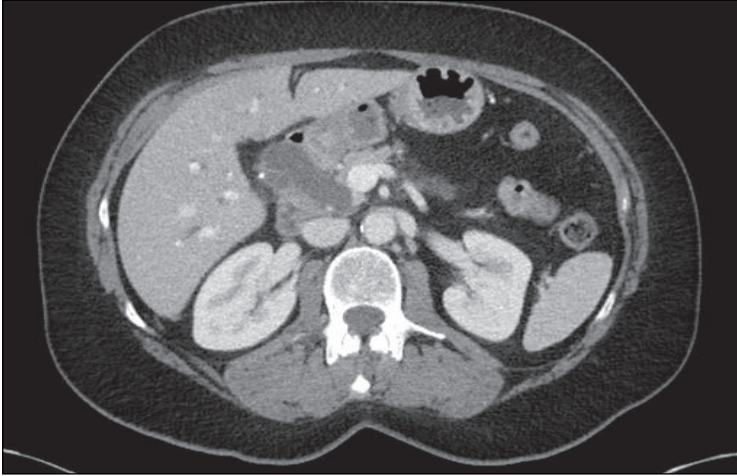


Figure 4.18 – Abdominal axial CT image showing a mass in the head of the pancreas

▣ **Task(s) to be performed:** Create a tension free, end to side PJ.

### ▣ Stressors | Challenge Questions for Learners

- What is the dunking technique?
- What does mucosa to mucosa mean?
- Where is the pancreatic duct located?
- When will you use a stent?
- What can make this anastomosis easier or safer?
- What is the chance of pancreatic leak?
- What if the pathologist calls in and says the pancreatic neck margin is positive?
- What does “follow the curve of the needle” mean?



Figure 4.19 – P-J model during the session. (Hot dog is used to simulate the pancreas)

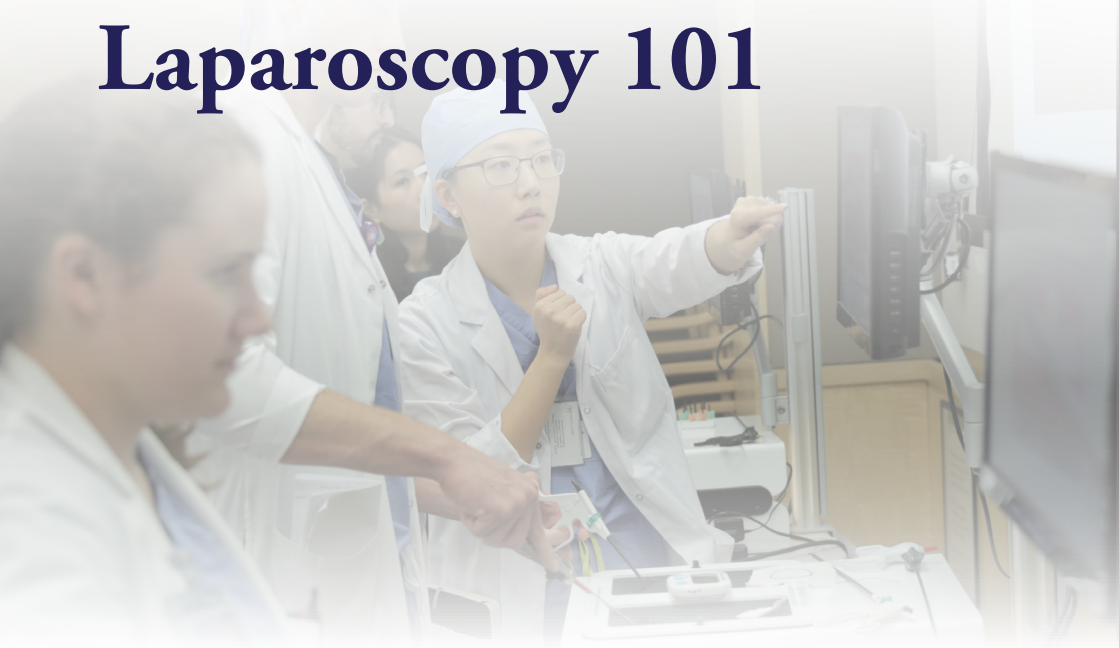
#### ▣ Topics to cover (skill session & debrief):

- Relevant anatomy for the P-J anastomosis.
- Post-op management of the patient.
- Meaning of pre-op: physical exam, labs (CBC, bilirubin, AST, ALT, CEA, INR, albumin).
- Meaning of pre-op: Imaging (US, CT, EUS).
- Learners will have simplified models for performing a mucosa to mucosa anastomosis.

#### ▣ Pearls

- Five keys to a good anastomosis: blood supply, no tension, patency, no distal obstruction and air-tight.
- Location of the PD (posterior 1/3).
- Margin - pathology considerations, is 1 cm enough? Yes.
- Avoid kinking of the small bowel, mobilize and plan ahead.
- Stents help with a tiny duct.
- Drains are useful when the risk of leak is high.

# Laparoscopy 101



## Overarching Goals

- Learn the basics of laparoscopic techniques (grasping, cutting and instrument handling)
- Introduce learners to FLS skills (peg transfer, knot tying, circle cutting) and procedural steps of lap cholecystectomy
- Learn the importance of applying appropriate traction and counter traction

In this session, we give PGY1 residents “hands-on” practice with minimally invasive surgery, how to perform a lap cholecystectomy, and the skills assessed with the Fundamentals of Laparoscopic Surgery (FLS).

**§ Objectives**

- Pass the FLS tests (peg transfer, circle cutting and knot tying test)
- Demonstrate and verbalize 5 factors to safely inserting a 5mm trocar into the abdomen
- Demonstrate 3 variants of tension: too little, just right and too much
- Define the components of the critical view of safety
- Use the clip applier proficiently to clip the cystic duct and artery

**§ Supplies (4 learners)**

|    |                       |   |                       |
|----|-----------------------|---|-----------------------|
| 12 | 3-0 Silk sutures      | 1 | Endo-Clip Applier     |
| 8  | Laparoscopic Graspers | 4 | Laparoscopic Scissors |
| 4  | Laparoscopic Maryland |   |                       |

**§ Models**

- Laparoscopic Cholecystectomy — p.144 ➤

## Scenario: Acute Cholecystitis

56 year-old female who is overweight presents with a h/o recurrent right upper quadrant pain for the past 5 months. The pain has now become severe and continuous for the past 5 hours. RUQ US shows signs of acute cholecystitis with gall stones.

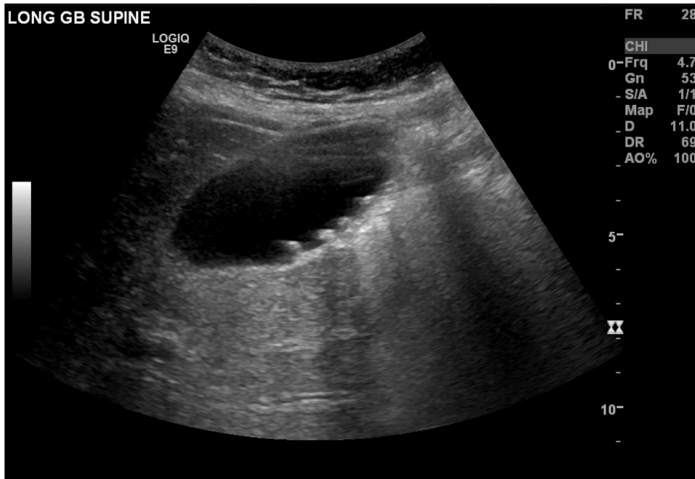


Figure 4.20 – Ultrasound of the RUQ showing stones within the gallbladder

▣ **Task(s) to be performed:** Laparoscopic cholecystectomy

### ▣ Stressors | Challenge Questions for Learners

- How thick is a normal GB wall?
- What is interval lap cholecystectomy?
- What are the indications for placement of a cholecystostomy tube?
- What if a stone is seen in the CBD?
- What will you do if you avulse the cystic artery during dissection?
- What is the sulcus of Rouviere? What is its significance?
- What is Murrizzi Syndrome?

### ▣ Topics to cover (skill session & debrief):

- Triangulation & location of ports.
- Different types of laparoscopes 0° & 30° & 45°, 5 & 10mm.
- The components of the critical view of safety.
- Boundaries of the triangle of Calot.
- Ultrasonographic signs of gall bladder pathology.
- How to use an endo-clip applier.

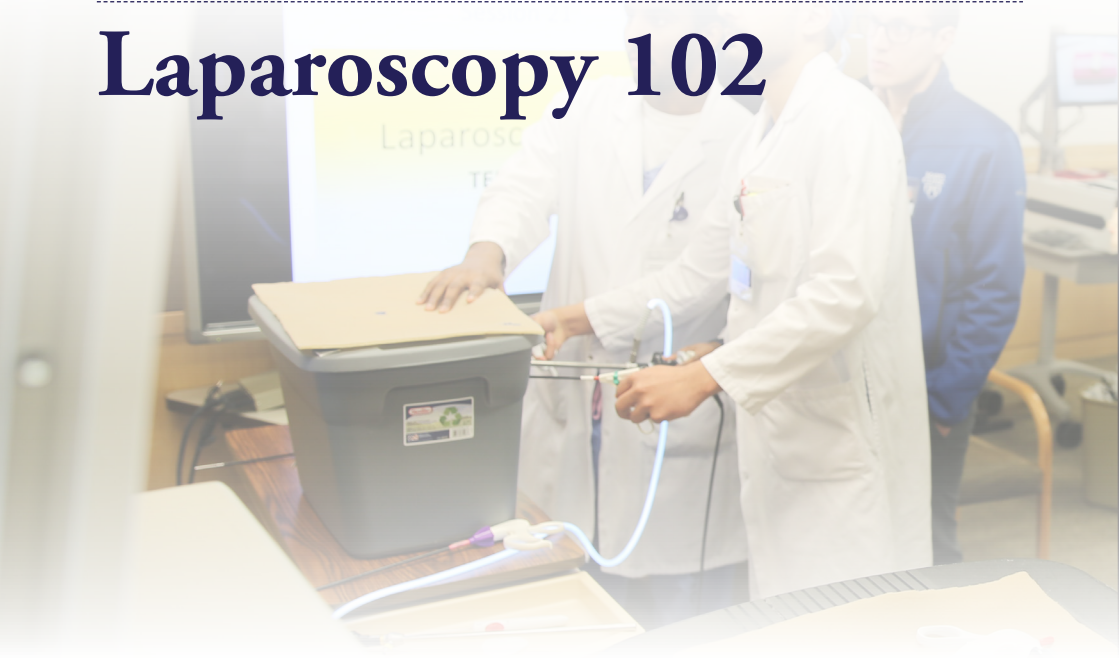


Figure 4.21 – Interns practicing on the laparoscopic cholecystectomy model

### ▣ Pearls

- GB wall thickness > 3mm is abnormal.
- Laparoscope located between your working ports is preferable (triangulation).
- Critical view of safety for lap chole: skeletonize cystic duct, cystic artery, and see liver through spaces with 30% of GB dissected free.
- Place clips perpendicular on vessels for most secure placement.
- Traction + counter traction = tension.
- Place tissue on tension THEN apply light touch with cautery to speed dissection.

# Laparoscopy 102



## Overarching Goals

- Enhance the basics of laparoscopic techniques (grasping, cutting and instruments handling)
- Introduce learners to positioning intra-abdominal and extraperitoneal mesh for TEP and ventral hernias
- Provide additional deliberate practice for FLS skills
- Master the principles of safe trocar placement



In this session, we give PGY1 residents additional practice with FLS tasks. A laparoscopic OR vignette will help crystallize important laparoscopic surgical techniques for TEP inguinal and ventral hernia repair and the benefit of surgical experience & insight.

## **§ Objectives**

- Describe the pelvic anatomy
- Measure, cut, and suture/tack mesh
- Demonstrate appropriate mesh coverage for hernias

## **§ Supplies (4 learners)**

|   |                                     |   |                       |
|---|-------------------------------------|---|-----------------------|
| 4 | Maryland Graspers                   | 4 | Laparoscopic Scissors |
| 1 | Veress Needle                       | 4 | Marking Pen           |
| 4 | Scissors                            | 1 | Tape                  |
| 2 | Laparoscopic Tacker/Fixation Device | 4 | 3-0 Silk Ligatures    |

## **§ Models**

- TEP Hernia Repair — p.136 ➤
- Ventral Hernia Repair — p.138 ➤

## Scenario: TEP Mesh Placement

32 year-old male patient has an indirect hernia on the right side. He is scheduled for elective TEP inguinal hernioplasty. The patient is in the OR and trocars have been introduced. Dissection of the hernia sac has been done.



Figure 4.22 – Axial CT image showing a right inguinal hernia

### Task(s) to be performed:

1. Cut the mesh and introduce it appropriately.
2. Unfold the mesh and place it appropriately to cover the current and potential hernia defects.

### Stressors | Challenge Questions for Learners

- How do you proceed if a direct hernia is found?
- Should you explore the contralateral side?
- Which mesh is best?
- What size mesh is too big?
- What size mesh is too small?
- How far should trocars be inserted?
- What difference do graspers make?
- What do you do if you tear the external iliac vein? Peritoneum?
- A post-op patient calls about post-op swelling in the groin. What do you want to know?

## Scenario: Ventral Hernia Repair

63 year-old healthy male with a previous exploratory laparotomy for splenectomy now complains of bulge and pain over his incision site.



Figure 4.23 – Axial CT image showing small bowel protruding through the abdominal muscles

### Task(s) to be performed:

1. Adhesiolysis.
2. Cut the mesh.
3. Introduce it appropriately.
4. Fixate and tack it to the abdominal wall.

### Stressors | Challenge Questions for Learners

- How will you manage a thermal injury to the small bowel?
- How far apart are the sutures placed on the mesh?
- How big should the panel of mesh be?
- How can you measure the hernia defect?
- What happens if you make an enterotomy?
- ER is calling about a patient with SBO (*show CT scan*). What should they/you do?
- Which mesh is best?
- Where should adhesions be lysed?

### ▣ Topics to cover (skill session & debrief):

- Anatomy of the abdominal wall.
- Describe and educate interns on TEP mesh creation, handling and placement.
- VHR choices (open, lap, robotic, onlay, inlay, underlay).
- Adhesiolysis – understand traction & counter traction.
- Coverage, > 3 cm overlap. More than 5 cm is better.
- Suture passer technique.
- Tacking (start where it is easiest).

### ▣ Pearls (TEP Repair)

- Find the deep inferior epigastric vessels early.
- The deep posterior aspect of the mesh belongs in the “groove”.
- Avoid poking the external iliac vessels.
- Use two hands at all times.
- Keep the tips of the instruments in view at all times.
- Bigger mesh = increased discomfort, but less hernia recurrence.



Figure 4.24 – Trainees working laparoscopically on placing the mesh for a TEP hernia repair



Figure 4.25 – Trainees lysing the adhesions off the abdominal wall on a ventral hernia repiair model

#### ❏ Pearls (VH Repair)

- Safe entry into abdomen: Hasson technique.
- Safe trocar insertion: more twisting than straight pressure.
- Concern/caution for enterotomy with adhesiolysis.
- Hernia coverage, overlap, fixation - wider is better.
- Trocars enter abdomen in a perpendicular path.
- Release the pneumoperitoneum for accurate suture fixation (i.e., lower the intra-abdominal pressure).

# Code 101: ACLS



## Overarching Goals

- Recognize and initiate early management of periarrest conditions that may result in cardiac arrest.
- Demonstrate proficiency with BLS & ACLS care, including prioritizing chest compressions and integrating Automated External Defibrillator (AED) use.
- Manage cardiac arrest until return of spontaneous circulation (ROSC), termination of resuscitation, or transfer of care.
- Demonstrate effective communication as a member or leader of a resuscitation team and recognize the impact of team dynamics on overall team performance.

Team dynamics are critical during resuscitation attempts. The interaction among team members has a profound impact on the effectiveness of each individual as well as the patient's overall survival.

In this session, three scenarios provide the opportunity to effectively lead and participate in the coordinated effort of a team trying to resuscitate a patient in severe distress.



Figure 4.26 – Trainee performing CPR as part of a simulated ACLS code scenario

## **§ Objectives**

- Perform effective CPR (100-120 compressions/min & 2" in depth).
- Describe refractory and unstable atrial fibrillation.
- Demonstrate proper definitive treatment: synchronized cardioversion.
- Identify an unresponsive Pulseless Electrical Activity (PEA) arrest.
- Identify symptomatic Supraventricular Tachycardia (SVT).
- Treatment of new-onset SVT: (1) try vagal maneuver (2) if that fails try Adenosine (6 mg IV followed by 12 mg if needed).
- Demonstrate proper pharmacologic management of PEA, VT, VF, and asystole.
- Clarify when to use the AED.



## Scenario #1: Mock Code: PEA

**Patient:** Mr. Jones (56 years old, 120 kg) is POD #2 from an open cholecystectomy (gangrenous cholecystitis). He is currently in the ICU. Past medical history of chronic renal insufficiency (stage 3, GFR 35), diabetes mellitus II, coronary artery stent placed in past, hypertension, and COPD on insulin, amlodipine, B-blocker, and tiotropium bromide. He was alert and oriented on rounds but suddenly became unresponsive 1.5 hrs after central line placement for definitive IV access. He has been NPO, IVF LR at 140 ml/hr.

### ▣ Patient Status

- **Last recorded vitals:** Temp 37.7°, HR 125, Regular, BP 98/56, Sat 88%, 2LNC.
- **CXR after CL:** image not yet available.
- **AM labs:** Hb 10.3 (stable), WBC 12K, Na 134 mEq/L, K 4.9, HCO<sub>3</sub> 20, Cr 1.3, T.Bili (1.7 / 2.4).
- **I's and O's:** +2.5L, UOP has dropped to 30 cc/hr in the last 4 hrs.
- **Current IVF:** LR at 140 cc/hr.
- **Rounding decisions this a.m.:** central line, hydrate, monitor UO.
- **Activity:** UOB to Chair. Sips clears.
- **Physical exam:** eyes shut, no pulse, BP undetectable, unresponsive to sternal rub.

### ▣ Task(s) to be performed:

1. Work together to reestablish a viable rhythm. Intubation and chest tube insertion will be required
2. Zoll Monitor (Rhythm)
3. PEA, VT, VF, Asystole, Sinus tachycardia, NSR
4. CPR
5. Airway: Start with BMV. Need airway adjunct (i.e. OPA, NPA), Need Intubation
6. **iStat Labs (if they ask for it):**  
Hct 27, K 5.0 mEq/L, iCa 3.99, Na 135 mEq/L, Glu 99,  
PaO<sub>2</sub> 50, PaCO<sub>2</sub> 55, pH 7.45, HCO<sub>3</sub> 22 mEq/L, Base -3

## Scenario #2: Mock Code: Unstable Atrial Fibrillation

**Patient:** Mrs. Walter (66 years, 100kg) was moved to the ICU 2 days ago for A. fib RVR after subtotal gastrectomy for adenocarcinoma. PMHx: HTN on Metoprolol. She has been on amiodarone drip for 2 days but has remained in A-fib RVR 130-150s but maintaining BP and mental status. She is POD #4. Afebrile and stable except over the last 6 hours her BP has steadily fallen from 130/80 to currently 85/60, she is somewhat pale, diaphoretic and cool to the touch. DVT/PE has been ruled out. Has been NPO with IVF (LR) at 120 cc/hr.

### ▣ Patient Status

- **Last recorded vitals:** Temp 37.4, HR 155 irregular, BP 85/60, Sat 85% 2LNC.
- **CXR (a.m.):** small bilateral effusions.
- **AM labs:** Hb 11.1 (stable), Na 134 mEq/L, K 4.8, HCO<sub>3</sub> 20, Cr 1.3
- **I's and O's:** +2.5L, UO has dropped to 30 cc/hr for the last 4 hrs.
- **Current IVF:** LR at 120 cc/hr.
- **Rounding decisions this a.m.:** R/O DVT/PE. Duplex negative, CT PE protocol negative.
- **Physical exam:** eyes open, irregularly irregular pulse, BP 85/60.

### ▣ Task(s) to be performed:

1. Work together to reestablish a viable rhythm. Intubation will be required
2. Zoll Monitor (Rhythm) Unstable A. fib with RVR, VF after cardioversion, VT Asystole and NSR
3. CPR
4. Airway: Start with BMV; will need intubation
5. **EKG (if asked for it):** A-fib HR 155 bpm, no ST changes
6. **iStat Labs (if they ask for it):**  
Hct 32, K 5.0 mEq/L, iCa 4.98, Na 137 mEq/L, Glu 87,  
PaO<sub>2</sub> 55, PaCO<sub>2</sub> 44, pH 7.41, HCO<sub>3</sub> 24 mEq/L, Base -1

### Scenario #3: Mock Code: SVT

**Patient:** Mrs. Johnson (66 yrs, 80kg) is POD #1 for right upper lobe lung resection for T<sub>3</sub>N<sub>0</sub>M<sub>0</sub> adenocarcinoma. She was in NSR but then flipped into SVT for the last 2 hrs. She complains of palpitations, light headedness, and chest pain. No incisional pain complaints. No major medical problems. She is complaining of feeling light-headed. Former smoker, quit 10 yrs ago. No meds. She has a single left sided chest tube (400cc serosanguineous fluid last 24 hrs). Last recorded vitals: Temp 37.4, HR 155 regular, BP 110/75, Sat 91% 2LNC. Large air leak from chest tube.

#### ▣ Patient Status

- **CXR (a.m.):** Large right sided pneumothorax
- **AM labs:** Hb 11 (preop was 13), WBC 10K, PLT 175K, Na 134 mEq/L, K 3.5 mEq/L, HCO<sub>3</sub> 24 mEq/L, Cr 0.9
- **I's and O's:** +2.5L, UOP at least 0.5 mL/kg/hr
- **Current IVF:** NS 40 cc/hr



Figure 4.27 – CXR showing bilateral chest tubes

▣ **Task(s) to be performed:**

1. Work together to reestablish a viable rhythm. Intubation and chest tube insertion will be required
2. Zoll Monitor (Rhythm): SVT , VT, VF, Asystole, NSR
3. CPR
4. Airway: Start with BMV and then intubate
5. **EKG (if asked for it):** Confirms SVT HR 155, no ST changes
6. **iStat Labs (if they ask for it):**  
**Hct 31, K 4.9 mEq/L, iCa 5.01, PaO<sub>2</sub> 75**  
**PaCO<sub>2</sub> 39,pH 7.39, HCO<sub>3</sub> 24 mEq/L, Base 0**

# Code 102: Trauma



## Overarching Goals

- Gain familiarity with interpreting ABGs.
- Introduction to endotracheal intubation.
- Introduction to trauma scenarios and management plans (ATLS).
- Learn about shock – hemorrhagic, septic, neurogenic, cardiogenic and SIRS.
- Fluid resuscitation: how much to give and when to stop.

In this session we give the residents “hands-on” practice on the basics of trauma and ICU skills. Three separate vignettes will crystallize important surgical techniques.

**§ Objectives**

- Define the 5 values of an ABG.
- Accurately interpret 3 basic ABG readings.
- Articulate 3 situations in which there is a need for intubation.
- Perform the steps of ET intubation, test it, and fix ET tube in the appropriate place.
- Utilize the ABCs and help run a trauma code.

**§ Supplies (4 learners)**

|    |                        |    |                     |
|----|------------------------|----|---------------------|
| 1  | Ultrasound Machine     | 1  | Mannequin           |
| 1  | Trauma Cart            | 2+ | IV Lines/Blood Bags |
| 2+ | Clamps/Scissors/Suture | 2+ | Chest Tube          |

**§ Models/Tools**

- Chest Tube Placement — p.123 ➤

## Scenario: MVA (Aortic Injury + Liver Injury)

16 year-old male patient involved in MVA 30 minutes ago. Patient is hypotensive (80/50 mmHg) & tachycardic (135 bpm). Patient has widened mediastinum on the chest x-ray.

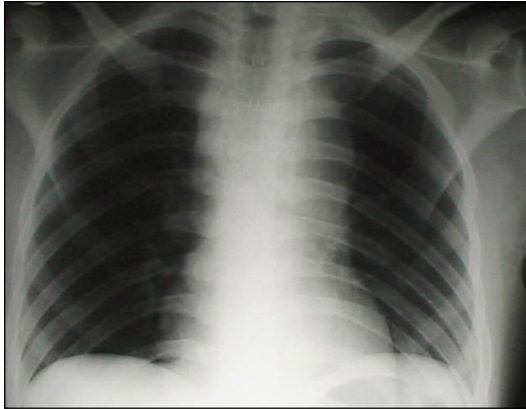


Figure 4.28 – CXR with widened mediastinum

### Task(s) to be performed:

1. Run the trauma code to the point of taking the patient to the OR.
2. Practice inserting a central line, a chest tube, ET tube and performing a F.A.S.T. (Focused Assessment with Sonography for Trauma) exam.

### Stressors | Challenge Questions for Learners

- Vital sign deterioration: when should we proceed to the OR?
- Nurse tells you the mom has shown up in ER, what will you do?
- Why ABC - why that order?
- When does blood become the fluid of choice?
- What are positive signs to the F.A.S.T. exam?
- How do you decide who the team leader is?
- Who should speak up during a resuscitation?
- What is SBAR?
- What if the team leader makes a mistake?





Figure 4.29 – Ultrasound with fluid in the hepatorenal space (Morison's pouch)

### ▣ Topics to cover (skill session & debrief):

- Fundamentals of F.A.S.T. exam
- Relevant surface anatomy for central line insertion
- Practice chest tube insertion
- Run the trauma code as a team
- Educator will discuss MVA management



Figure 4.30 – Trainee intubating the patient (left), debriefing room with live-feed from the scenario rooms (right)

### ▣ Pearls

- ABC - always!
- When in doubt check ABC's.
- Ask for vitals and consider getting repeat ABGs.
- Team approach: confirm actions and repeat vocally.

# Pediatric Surgery



## Overarching Goals

- Understand that children are not just little adults.
- Gain experience and confidence with lap appendectomy.
- Learn the basics of pyloric stenosis and how to diagnose and treat it.

This session of our surgical simulation curriculum aims to offer education and experience with Pediatric Surgery. Utilizing accute appendicitis and pyloric stenosis facilitates learning about surgery on children.

## **§ Objectives**

- Diagnose and surgically treat pyloric stenosis
- Apply an Alexis wound retractor/single-incision set up
- Create a window in the mesoappendix, divide the mesoappendix appendiceal artery and transect the appendix

## **§ Supplies (4 learners)**

|    |                    |   |                      |
|----|--------------------|---|----------------------|
| 4  | Tissue Forceps     | 4 | Needle Drivers       |
| 4  | Scalpels           | 4 | Curved Clamps        |
| 4  | Scissors           | 1 | Tape                 |
| 12 | 3-0 Silk ligatures | 4 | 3-0 Vicryl ligatures |

## **§ Models**

- Laparoscopic Appendectomy — p.131 ➤
- Pyloric Stenosis — p.133 ➤

## Scenario: Appendicitis

8 year-old male presents with 12 hours of RLQ pain. Patient has nausea and vomiting. Patient looks anorexic. US shows acute appendicitis.



Figure 4.31 – Alexis wound retractor and ports

### Task(s) to be performed:

1. Place the Alexis wound retractor.
2. Perform a single port laparoscopic appendectomy.

### Stressors | Challenge Questions for Learners

- Who was Reginald Fitz?
- What if the appendiceal base is inflamed?
- What if US/CT shows an abscess? Surgery vs. Percutaneous drainage?
- What is the ligament of Treves?
- What if the ileum has Crohn's disease?

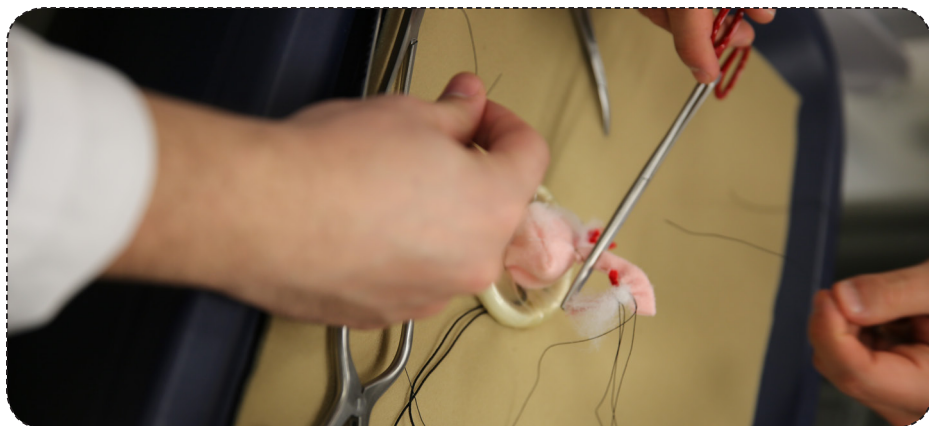


Figure 4.32 – Trainee performing an appendectomy. Getting ready to excise the appendix.

#### ▣ Topics to cover (skill session & debrief):

- Appendicitis presentation and workup
- Single lap. appendectomy setup
- Appendiceal transection
- Differences in pediatric vs. adult appendicitis
- Diagnose and manage strategies for common pediatric conditions: (pyloric stenosis, intussusception)

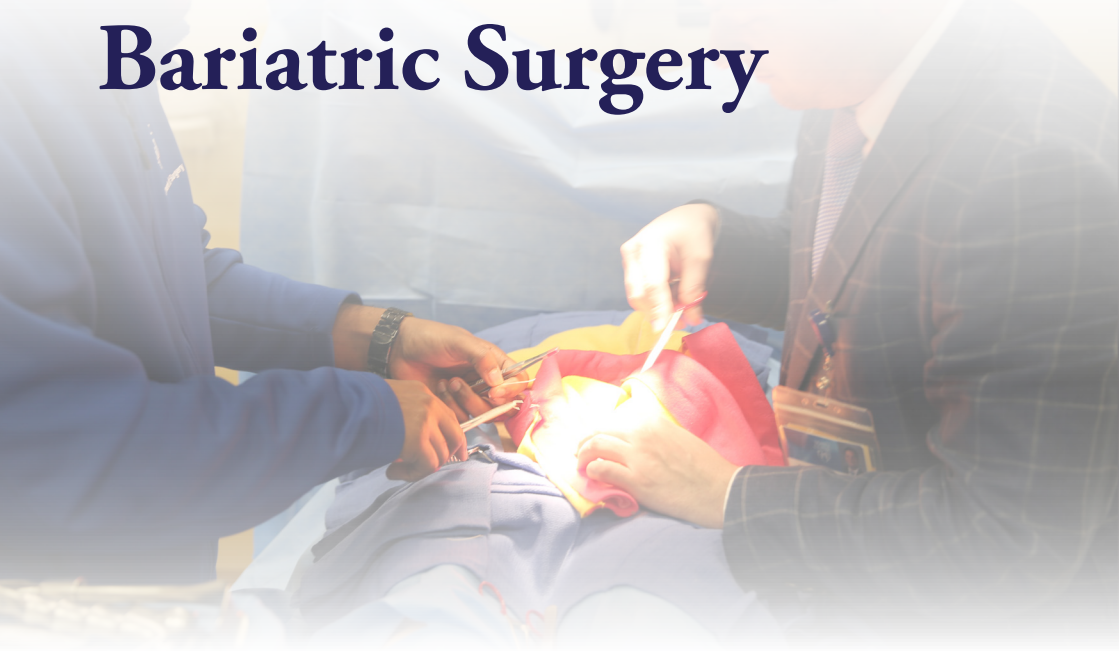


Figure 4.33 – Trainee performing a pyloromyotomy

#### ▣ Pearls

- Make sure the appendiceal base is normal.
- Appendiceal arteries like to bleed. Check hemostasis.
- Hydrate and balance electrolytes BEFORE surgery in patients with pyloric stenosis.
- Protect wounds from pus. Irrigation. Plastic bags. Think ahead!

# Bariatric Surgery



## Overarching Goals

- Introduce learners on how to use the EndoStitch device.
- Introduce learners to the basics of upper endoscopy - EGD.
- Gain understating of Roux-en-Y anatomy & physiology.

In this session learners will learn the basics of bariatric surgery and how to perform a Roux-en-Y Gastric Bypass (RYBG), along with the fundamentals of using the EndoStitch device.

### **§ Objectives**

- Perform simple interrupted and running stitch with the endostitch
- Articulate the procedural steps of a RYGB
- Demonstrate the internal hernias associated with RYBG
- Perform a G-J anastomosis

### **§ Supplies (4 learners)**

|    |                   |   |                   |
|----|-------------------|---|-------------------|
| 4  | Tissue Forceps    | 4 | Needle Drivers    |
| 4  | Scalpels          | 4 | Curved Clamps     |
| 4  | Scissors          | 1 | Tape              |
| 12 | 3-0 Silk suture   | 4 | 3-0 Vicryl suture |
| 4  | EndoStitch Device | 4 | EndoStitch Loads  |

### **§ Models**

- Roux-en-Y Gastric Bypass — p.145 ►



## Scenario: RYGB Gastrojejunostomy Anastomosis

49 year-old male with Diabetes Mellitus II and a BMI of 51 is undergoing an open Roux-en-y Gastric Bypass. The jejunum has been divided. You are asked to complete the G-J anastomosis.



Figure 4.34 – Roux-en-Y Gastric Bypass Model

▣ **Task(s) to be performed:** G-J anastomosis

### ▣ **Stressors | Challenge Questions for Learners**

- Who was Roux?
- Why does a RYGB help patients lose weight?
- What is a Peterson hernia?
- What do you do if the stapler fails?
- How can you be sure the small bowel is not twisted?
- What do you do if the CRNA/anesthesiologist says the HR is up and BP is down?



Figure 4.35 – Proctor teaching a trainee how to use the EndoStitch device (left), making a loop to tie a secure knot using (right)

#### ▣ Topics to cover (skill session & debrief):

- Restrictive vs. malabsorptive techniques
- Internal hernias associated with RYGB
- Uses of the EndoStitch device

#### ▣ Pearls

- Openings in the mesocolon are closed to avoid internal hernias
- The gastric pouch must be small (< 30 cc)
- Post-op tachycardia? Think leak!

# Colorectal Surgery



## Overarching Goals

- Review the anatomy and blood supply of the lower GI tract
- Teach skills and the principles of safe anastomoses
- Introduce learners to the principles of resection of colon cancer
- Introduce learners to the principles of stoma creation
- Introduce learners to using the colonoscope and the Fundamentals of Endoscopic Surgery (FES) tasks

## § Objectives

- Accurately construct blood supply to colon, rectum, and anal canal
- Create a safe ileostomy and colostomy
- Explain the principles of colon cancer resection (margins, blood supply, lymph nodes)
- Perform a colon cancer resection and anastomosis

## § Supplies (4 learners)

|    |                  |   |                    |
|----|------------------|---|--------------------|
| 4  | Tissue Forceps   | 4 | Needle Drivers     |
| 4  | Scalpels         | 4 | Curved Clamps      |
| 4  | Scissors         | 1 | Tape               |
| 12 | 3-0 Silk sutures | 4 | 3-0 Vicryl sutures |

## § Models

- Colostomy/Ileostomy — p.142 ➤
- Yazanoscope — p.146 ➤

## Scenario #1: Colostomy and Ileostomy

**PATIENT 1:** 32 year-old female. Hx of Crohn's disease for 20 years. Total colectomy was performed 2 years ago for refractory disease. Segmental resection of the ileum has been performed today.

**PATIENT 2:** 71 year-old female. Advanced rectal cancer requiring a palliative loop sigmoid colostomy.

### ▣ Task(s) to be performed:

Perform an end ileostomy and a loop sigmoid colostomy.

## Scenario #2: Colon Adenocarcinoma

82 year-old male with a history of hematochezia. Hb: 8.7, WBC: 11.2. Colonoscopy revealed tissue growth in proximal ascending colon. Biopsy shows an adenocarcinoma.

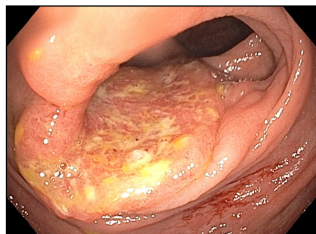


Figure 4.36 – Colonoscopy image showing atypical mucosa that is likely malignant

### ▣ Task(s) to be performed: Right hemicolectomy.

### ▣ Stressors | Challenge Questions for Learners

- ER calling with a patient who had a barium enema showing a rectal obstruction and a CT scan illustrating liver mets. Does this patient need surgery?
- ER calling: patient with high output ileostomy and dehydrated. What should they do?
- ER calling: patient with parastomal hernia. What should they do?

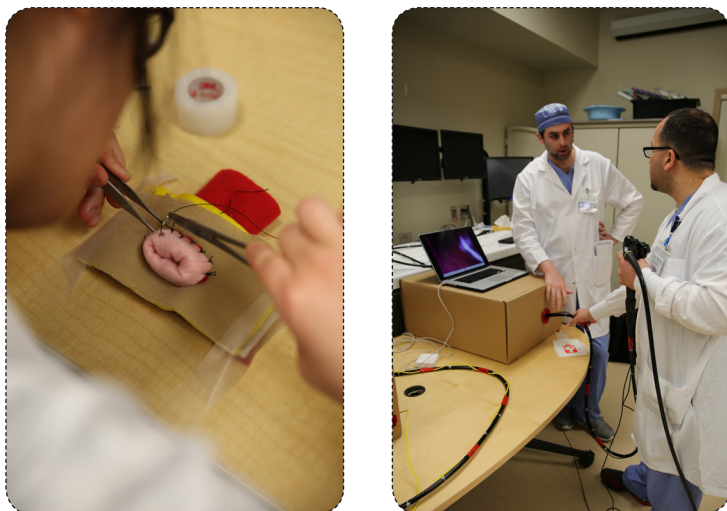


Figure 4.37 – Trainee creating an ileostomy (left), trainees working on the Yazanoscope to learn colonoscopy (right)

#### ▣ Topics to cover (skill session & debrief):

- Instructor will describe and educate trainees on ostomies, appliances, pre-emptive planning, etc.
- Indication for ostomies and common complications.
- The advantage of staged operations: 1, 2, 3 stages.
- Hartmann procedure: what is it? Who was he?
- Learners will have models available to practice on performing ileostomy and colostomy in the debrief room.

#### ▣ Pearls

- Plan for the stoma site: caudal and lateral to the umbilicus is preferred and avoiding belt or pant line.
- Bringing the stoma lateral to lie within the rectus is preferred.
- Perform mucosa to skin anastomosis.
- Remember the location of deep inferior epigastric vessels.
- Fashioning the mesentery, preserve the marginal artery.
- Protect the subcutaneous fat from fecal contamination.
- Make sure your sutures evert the bowel mucosa.

# Acute Abdomen



## Overarching Goals

- Know the common causes of acute abdomen
- Learn about gastric and duodenal perforation and how to repair them
- Introduce learners on how to "run" the small bowel



In this session we cover the basics of diagnosing and managing patients with an acute abdomen. Learners will work on repairing a duodenal perforation, resecting the appendix, and running the small bowel laparoscopically.

**§ Objectives**

- Repair duodenal perforation with Graham patch
- Describe the clinical presentation and management of acute abdomen
- Verbalize the principles of safe anastomosis and relieving obstructed small bowel

**§ Supplies (4 learners)**

|    |                  |   |                    |
|----|------------------|---|--------------------|
| 4  | Tissue Forceps   | 4 | Needle Drivers     |
| 4  | Scalpels         | 4 | Curved Clamps      |
| 4  | Scissors         | 1 | Tape               |
| 12 | 3-0 Silk sutures | 4 | 3-0 Vicryl sutures |

**§ Models**

- Appendectomy — p.131
- Graham Patch Repair — p.142
- Small Bowel Run → Abdomen (Base Model) — p.118



Figure 4.38 – Proctor observing trainees working to perform a laparoscopic appendectomy

#### ▣ Task(s) to be performed:

- Perform an open appendectomy
- Perform a Graham patch

#### ▣ Topics to cover (skill session & debrief):

- Most common causes of acute abdomen (inflammation, perforation, obstruction, ischemia, ... etc) and how to manage them.
- Graham patch vs. modified Graham patch repair
- Running the small bowel



Figure 4.39 – Trainee closing a duodenal perforation using the Graham patch technique (left), trainees performing a laparoscopic appendectomy (right)

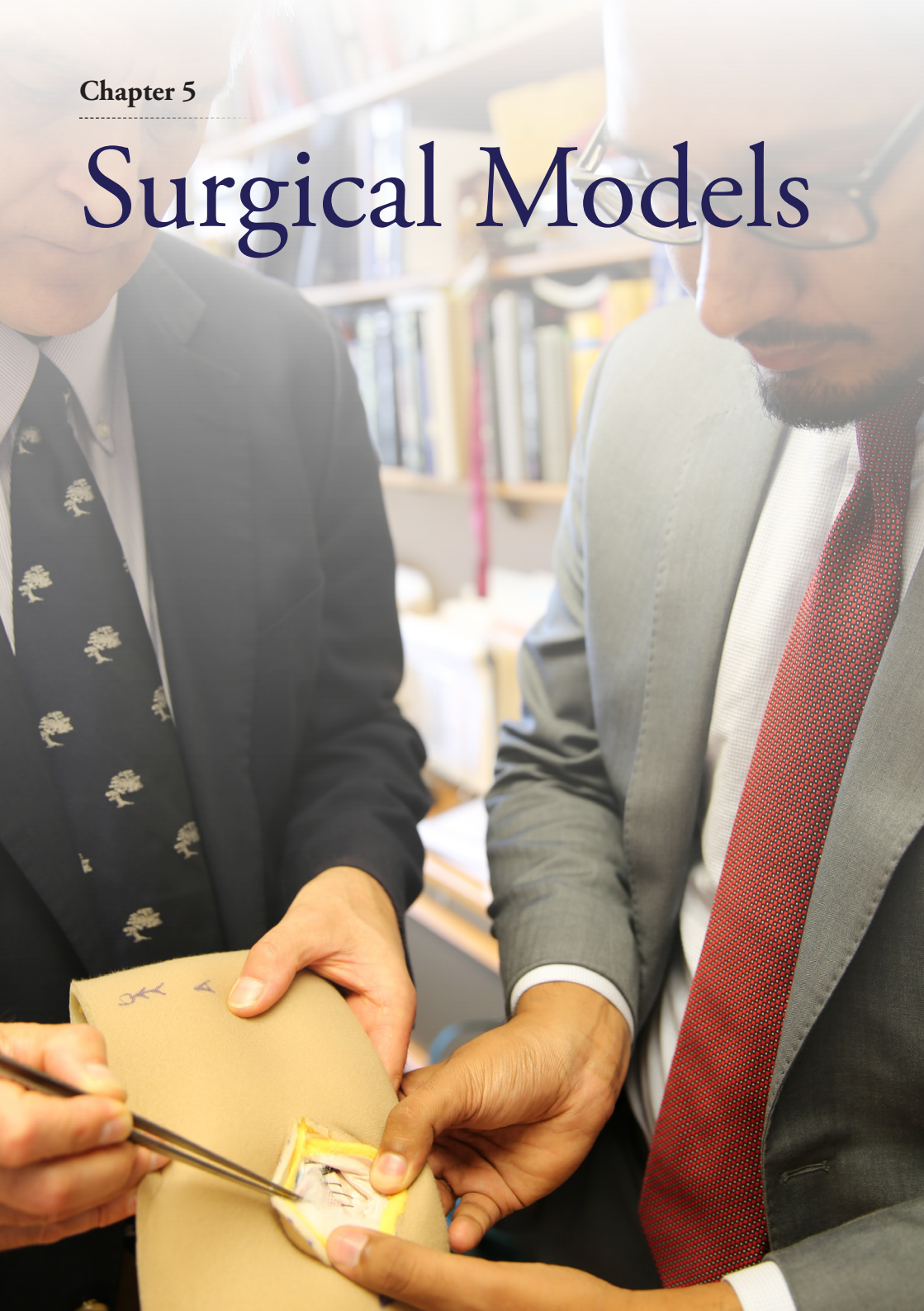
### ▣ Pearls

- Most abdominal pain is benign.
- Repeat complaints warrant study.
- Gastric perforations (acid) typically give immediate symptoms (seconds).
- More distal perforations (small bowel, colon) generate symptoms in minutes to hours to days.
- Remember common things occur commonly, rare things occur rarely.
- Bowel ischemia causes miserable pain.
- Sometimes the safest place for patients with an acute abdomen is the operating room.

Chapter 5

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# Surgical Models



In this chapter we provide instructions and tips on how to recreate most of the models described in this book.

## **Model List**

|                                      |     |
|--------------------------------------|-----|
| <b>1. Basic Skills</b>               |     |
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| – Chest tube placement               | 123 |
| – Cricothyrotomy                     | 122 |
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| <b>2. Breast Models</b>              |     |
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| <b>6. Yazanoscope</b>                | 146 |

## Before You Start

Our models are used many times throughout the year that serve a large number of learners. We have listed the tools that are used in most of the builds. We have also included a few tips we think will help you recycle and reuse the models.



Figure 5.1 – Most commonly used tools

- Glue gun & sticks
- Sharp *fabric* scissors
- Craft knife/blade (e.g., X-Acto)
- Velcro
- Tape
- Binder clips
- Markers
- Rulers

### Important Building Tips

- When using the **glue gun** avoid the working areas (e.g., around incisions). As the glue cools down and hardens, it will be very difficult to cut through or sew on it. Use sensibly on yarn!
- Use sharp scissors (or blade) to make the incisions through felt. Make cuts on each layer separately.
- Use Velcro instead of glue on parts that are replaceable instead of having to redo the whole model (e.g., Fascial closure, Thyroid, Adrenalectomy, etc.).



## Material Stock

While this list is extensive, similar materials and colors can be used in place of those listed.

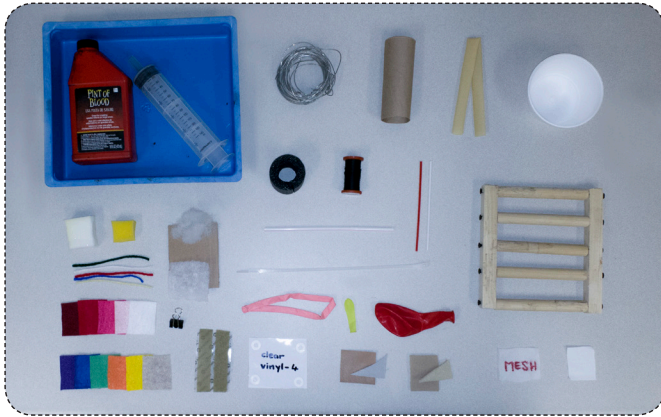


Figure 5.2 – Layout of the material stock

1. Balloon (long and thin)
2. Balloon (regular)
3. Balloon (small)
4. Binder clips (small)
5. Cardboard
6. Clear vinyl (gauge-4)
7. Cotton batting (or polyester)
8. Fabric - White
9. Felt →
  - Maroon – Red
  - Hot pink – Pink
  - White – Purple
  - Blue – Green
  - Orange – Yellow
  - Tan
10. Halloween blood
11. Headliner (Tan)
12. Memory Foam
13. Mesh
14. Penrose (rubber tube)
15. Pipe-insulation foam
16. Plastic tray
17. Sausage (veggie)
18. Sponge
19. Straws (small & regular)
20. Stuffing (cotton)
21. Styrofoam cup
22. Syringe
23. Thread
24. Toilet-paper roll
25. Velcro
26. Vinyl - Tan
27. Yarn - Blue
28. Yarn - Green
29. Yarn - Red
30. Yarn - White
31. Yarn - Yellow
32. Zip-ties
33. Wire
34. Wooden Frame (+ screws)



## Abdomen (Base Model)

This is the basic build of the abdomen that is used repeatedly on different models that require a more detailed anatomy of the abdomen.

### § Required Materials

- Felt (blue, brown, green, pink, purple, red, tan, yellow)
- Yarn (blue, red, yellow)
- Cardboard
- Stuffing (cotton)

### § How to build

- Make the solid abdominal organs (liver, gall bladder, stomach, spleen, kidneys, adrenals, duodenum, pancreas, small bowel, colon, appendix, bladder) out of a suitable felt color (2 layers of felt stuffed).
- Make the mesentery out of two layers of cotton fabric adding the blood vessels in between.
- Make the major vessels (abdominal aorta, IVC, portal vein, celiac, SMA, SMV, renal vessels) with felt (2D or 3D forms).
- Use the yarn to make small branches of vessels and ureters.
- Cut the felt into the shapes of the major abdominal organs and vessels using the corresponding colors (e.g., liver-brown, pancreas-yellow, spleen-purple, aorta-red, IVC-blue, omentum-yellow, etc.)



Figure 5.3 – Base model with all major organs (left), covered with omentum (right)

# Anatomy

## (abdomen, groin, neck)

### § Required Materials

- Felt (blue, brown, green, pink, purple, red, tan, yellow)
- Yarn (blue, red, yellow)

### § How to build

- Cut the felt into the shapes of the major organs and vessels using the corresponding colors (e.g., liver-brown, pancreas-yellow/orange, spleen-purple, aorta-red, IVC-blue, omentum-yellow, etc.).
- Cut the yarn into various lengths to represent vasculature.

«refer to the scoring sheet lists for the organs and vessels»

- Abdomen anatomy (p. 160) ➤
- Groin anatomy (p. 161) ➤
- Neck anatomy (p. 162) ➤



Figure 5.4 – Different anatomical structures made out of felt and fabric

# Skin Closure

## § Required Materials

- Headliner (tan)

## § How to build

- Cut the headliner 6x14 cm.
- Make a longitudinal 10 cm incision.
- Mark the first 2.5 cm (1-inch) on one side of the incision.

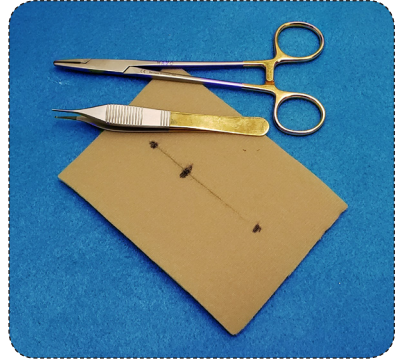


Figure 5.5 – Skin closure model

# Skyving Model

## § Required Materials

- Headliner (tan)
- Sponge

## § How to build

- Make a groove (umbilicus) in the middle of the SQ tissue (sponge).
- Cover the model with the skin (headliner).

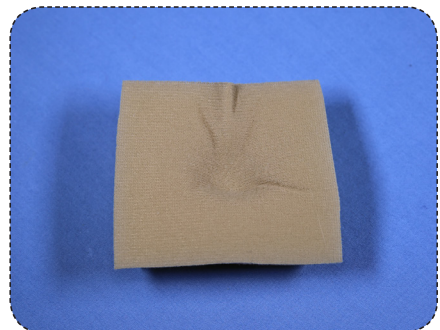
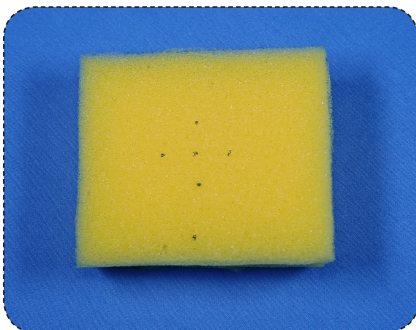


Figure 5.6 – Sponge with markings to make the groove (left), final model covered with skin (right)

# Balloon Knot Tying

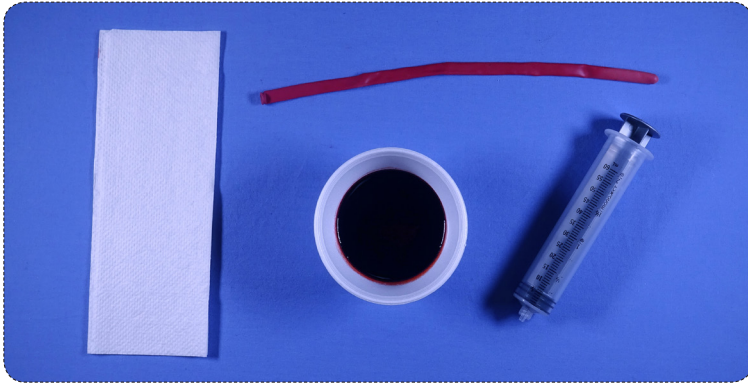


Figure 5.7 – Materials used to build the model

## § Required Materials

- Balloons (thin & long)
- Fake blood (or suitable replacement)
- Small plastic tray
- Binder clips (small)
- Syringe (without needle)

## § How to build

- Fill the balloons with the fake blood using the syringe (~ 3 cc) then tie. No need to stretch the balloons. Filling of 60-70% will do the job.
- Attach both ends of the balloon to the walls of the plastic tray using the binder clips. Making sure that the balloon is stretched enough and is not touching the bottom of the tray.



Figure 5.8 – Final look with balloon secured to the side of the tray

# Cricothyrotomy

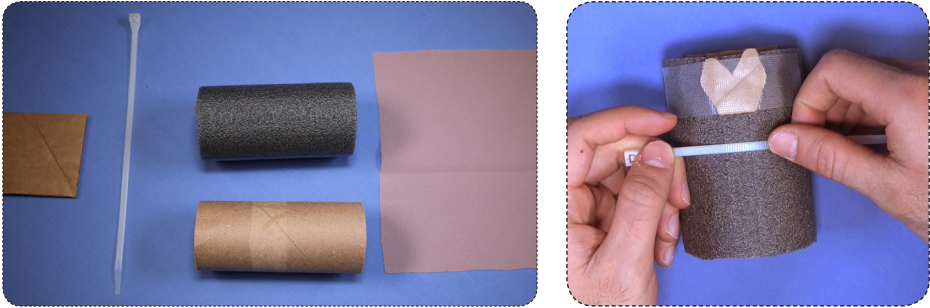


Figure 5.9 – Materials used to build the model (left), wrapping the zip tie around the foam (right)

## § Required Materials

- Toilet-paper rolls
- Pipe-insulation foam ( $\frac{1}{2}$  inch thickness)
- Cardboard
- Zip ties
- Fabric (tan)

## § How to build

- Cut a piece of the pipe-insulation foam to match the length of the toilet-paper roll, then wrap it around the roll. Make sure it covers more than  $\frac{1}{2}$  of the roll circumference.
- Cut out the shape of the thyroid cartilage from the cardboard and glue it on top of the foam.
- Wrap the zip tie around the foam (and the roll) to represent the cricoid ring. Position it below (inferior to) the thyroid cartilage. Leave enough space in-between (1-3 cm).
- Cut a piece of the fabric to cover the model. You can glue it on the model or tape it directly on the table.
- Make sure the toilet paper roll is not crumpled or crushed by the zip tie so that it gives a realistic “pop” feeling and sound.

## Chest Tube Placement



Figure 5.10 – Complete chest tube model showing the back and the front

### § Required Materials

- Headliner (tan)
- Vinyl (clear) - Gauge 4
- Cotton batting
- Wooden base (frame, dowels/rods, screws)

### § How to build

- **Building the base:** attach the dowels to the wooden frame, spaced-out 2-3 cm apart using the screws.
- To cover the base, cut appropriate sizes of each of the clear vinyl (parietal pleura), cotton batting (soft tissue), and headliner (skin).
- Make small slits on the sides of the layers to fix them on the screw-heads on the sides of the wooden base.
- Keep the clear vinyl on tension to effectively simulate popping the parietal pleura.



# Fascial Closure



Figure 5.11 – Finished look of fascial closure model

## **§ Required Materials**

- Headliner (tan)
- Cardboard box
- Felt (yellow, white, *optional: pink*)
- Velcro

## **§ How to build**

- The cardboard box is used as a housing to support the model. Make a rectangular hole (14 x 8 cm) in the center of the top surface of the box. Inside the box is representing the intra-abdominal cavity.
- On the top surface of the box, you will add the three layers to represent part of the abdominal wall. Cut rectangular pieces of each of the following layer enough to cover the top of the box.
- Tan felt representing the skin, yellow felt representing the SQ fat, white felt representing the fascia.
- Align the layers on top of each other, make 10cm incision in the middle of each layer (make sure it aligns with the hole in the top of the box).
- Using a glue gun, attach the layers on the top of the box at the four outer corners.
- Optional: make loops out of the pink felt and attach it to the inside of the box representing some bowel loops.



## § Tips

- Use sharp scissors or blade to make the incisions through each layer (skin, fat and fascia). Keep the incisions sharp and neat.
- When using the glue gun to attach the layers together, avoid the working areas (around the incisions). As the glue gun hardens, it will be impossible to sew on it.
- To reuse the model for a large number of learners, attach the fascial layer to the cardboard using Velcro.



Figure 5.12 – Fascial closure model with the abdominal wall layers turned to the side

# Bilateral Mastectomy Closure

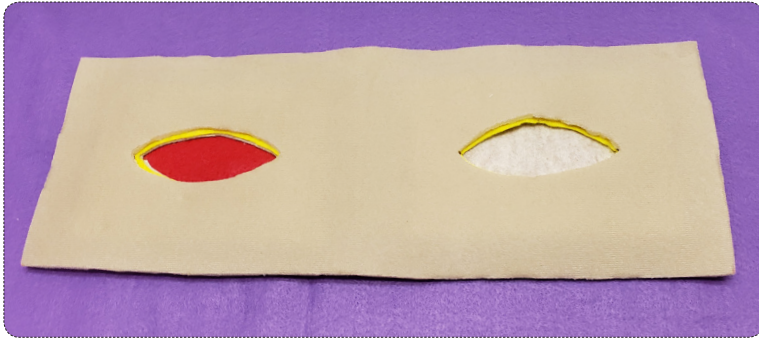


Figure 5.13 – Bilateral mastectomy closure model

## § Required Materials

- Headliner (tan)
- Felt (red, yellow, white)

## § How to build

- Cut a rectangular piece of headliner (skin) that is enough to represent both sides of the chest (approximately 17 x 44 cm).
- Of each color of the felt, cut two squares; yellow for fat, white for fascia, and red for pectoralis muscle (approximately 9x13 cm).
- Attach separate layers of muscle, fascia, and fat to each other at the outer corners with glue gun. Make two, one for each side.



Figure 5.14 – Side view showing the layers of the chest wall

- On the skin pad mark the midline, and then mark the middle of each side. From one of the center marks make a horizontal incision (10cm) and a vertical incision (3cm). Repeat the same steps on the other center side (this will reflect the bilateral mastectomy elliptical incisions).
- Repeat the same incisions on the fat and fascia layers and leave the muscle layer intact.
- Now you can attach the fat/fascia/muscle layers underneath the skin layer on both sides. Keeping in mind to align the incisions on top of each other.

## Mastectomy Drain Placement

### § Required Materials

- Headliner (tan)
- Felt (red, yellow, white)

### § How to build

- Stack four pieces of the felt according to the following order from bottom up (Red: pectoralis muscle, white: fascia, yellow: fat, and the headliner as the skin).
- Make an elliptical incision on the skin and the fat layers.

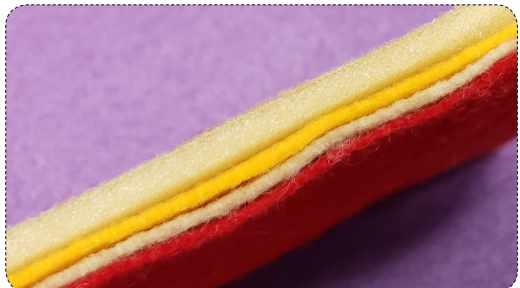
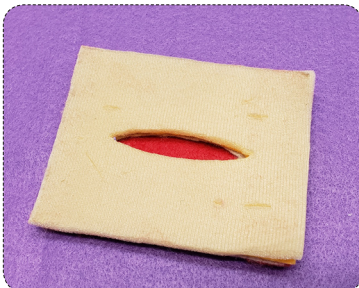


Figure 5.15 – Mastectomy drain placement model (left), side view showing the layers (right)

# Breast Wire Localization

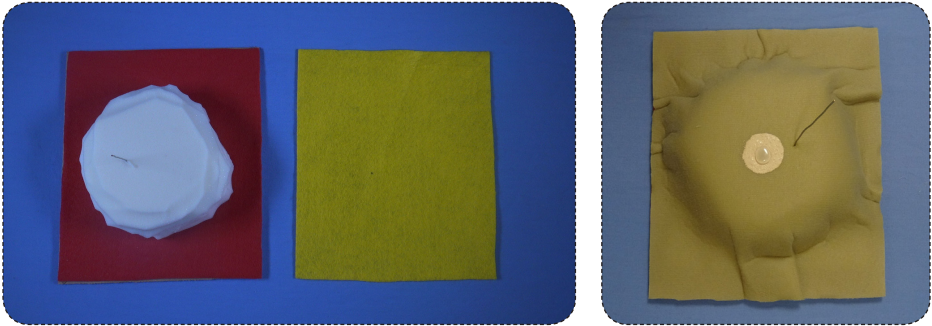


Figure 5.16 – Sponge on top of the 'pectoralis muscle' (left), finished breast wire localization model (right)

## **§ Required Materials**

- Headliner (tan)
- Felt (yellow, red)
- Cardboard
- Wire
- Sponge/memory foam

## **§ How to build**

- Attach the red felt (pectoralis muscle) to the cardboard.
- Cut the sponge to the shape of a hemisphere (breast tissue).
- Bend the edge of the wire (J shape) and insert the curved end into the sponge.
- Cover the model with yellow felt (fat) and the tan headliner (skin).
- Mark the nipple.

# Small Bowel Anastomosis

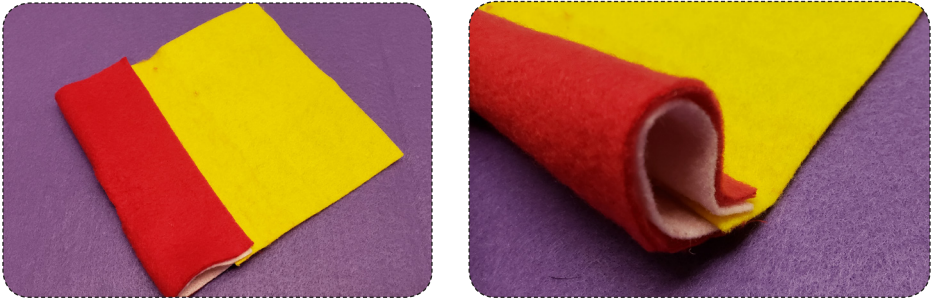


Figure 5.17 – Small bowel anastomosis model (left), side view of the model showing mucosa & serosa

## § Required Materials

- Felt (red, pink, yellow)

## § How to build

- Cut two pieces of red (serosa) and pink felt (mucosa).
- Cut a rectangle from the yellow felt (mesentery) with the shorter side (height) being the same length as the pink and red pieces.
- Fold the red and pink layers one-time, with the pink layer being on the inside.
- Insert the mesentery into the fold and glue it to the other layers.

## Small Bowel with Mesenteric Vessels

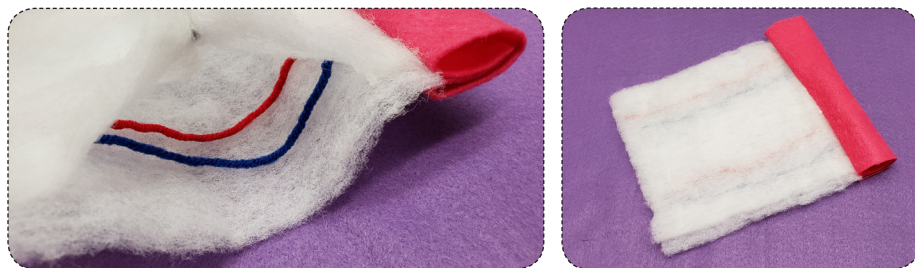


Figure 5.18 – Side view of the model showing the vessels within the mesentery

### **§ Required Materials**

- Felt (red, pink)
- Yarn (red, blue)
- Cotton batting

### **§ How to build**

- Cut the red and pink felt (bowel serosa) into 6 x 15 cm and fold them.
- Cut the cotton batting into 15x20 cm (mesentery).
- Cut the red and blue yarn into 20 cm long strings (mesenteric arteries and veins).
- Lay the blue and red yarn on top of one layer of the cotton batting. Arrange them to resemble the mesenteric blood vessels.
- Glue the batting layer and vessels to the bowel layers at the folds. Now you have the mesentery with vessels.
- Useful tips:
  - To align the bowel layers neatly, make the mucosa layer 1 cm narrower than the serosa layer.
  - For creating faster and cheaper mesentery, use yellow felt and draw arteries and veins with red and blue markers



# Appendectomy

## § Required Materials

- Felt (tan, pink)
- Headliner (tan)
- Yarn (red)
- Cardboard
- Cotton batting

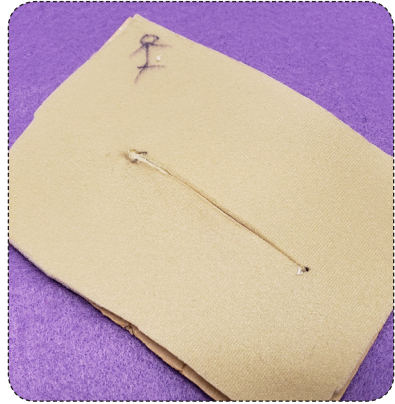


Figure 5.19 – Appendectomy model (left), model base with incision (right)

## § How to build

- Cut the shape of the cecum and appendix out of the tan felt. Attach a small part of the terminal ileum (pink) to the cecum.
- Attach the mesentery and the meso-appendix (cotton batting) to the medial side of the cecum. Add the mesenteric vessels (red yarn) in between the mesenteric layers.
- Attach the model to the base cardboard using Velcro.
- Cover the model with skin (headliner).



# Hepatojejunostomy

## § Required Materials

- Felt (red, pink, maroon, yellow)
- Cardboard
- Penrose or balloon (thin)



Figure 5.20 – HJ Model

## § How to build

- Make a bowel loop (mucosa: red, serosa: pink, and mesentery: yellow felt) and attach it to one side of the cardboard.
- Add the liver edge (maroon felt) to the other side of the cardboard.
- Attach the Penrose to the liver edge.

# Pancreatojejunostomy

## § Required Materials

- Felt (red, pink, yellow, orange)
- Cardboard
- Straw (thin)
- Sausage/Hot dog

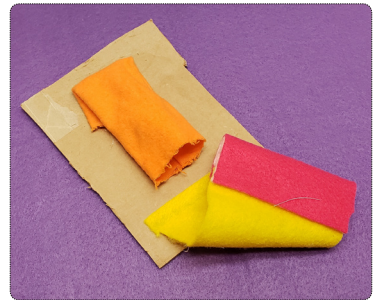


Figure 5.21 – PJ Model (without hot dog)

## § How to build

- Make a bowel loop and attach it to the one side of the cardboard.
- Make the pancreas pocket (orange felt) of a size to fit the pancreas (hot dog). Add the pancreatic duct (a short piece of straw to the middle of the hot dog).
- Attach the pancreas to the other side of the cardboard.

# Pyloric Stenosis

## § Required Materials

- Felt (Pink)
- Cardboard
- Pipe-insulation foam
- Water balloons (small)
- Stuffing

## § How to build

- Cut the pink felt into the shape of the stomach, including the pylorus and the first part of the duodenum. Make sure you have enough width on the pyloric area.
- Make the hypertrophied muscularis layer by cutting a piece of the pipe insulation foam 2-3 cm in length. Decrease the thickness of the foam to about 5mm by scraping a layer from the inner surface with a blade or scissors.
- Fill the water balloon (mucosa and gastric juice) with water and carefully wrap the piece of foam around it.
- Carefully glue the foam to the cardboard making sure you don't puncture the balloon, then cover it with the stomach cut-out.
- Fill the stomach with stuffing before fully closing it.

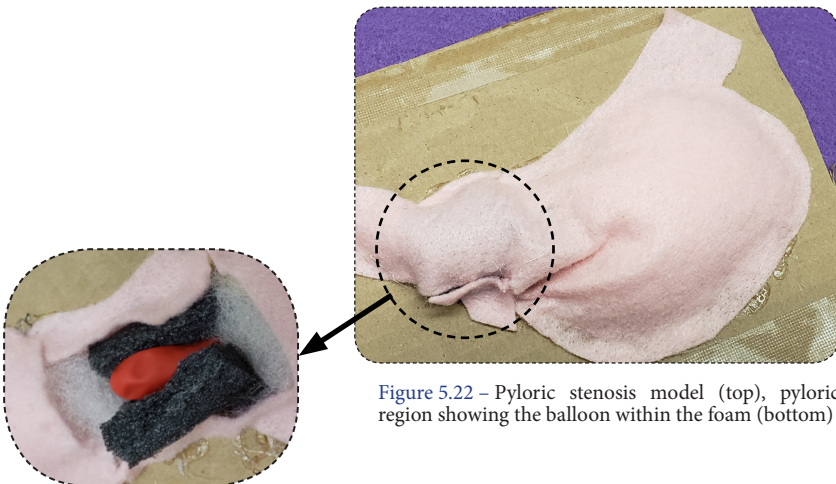


Figure 5.22 – Pyloric stenosis model (top), pyloric region showing the balloon within the foam (bottom)

# Laparoscopic Small Bowel Run

## § Required Materials

- Felt (red, pink, yellow, green, blue, maroon)
- Yarn (red, blue, yellow)
- Cotton batting
- Cardboard
- Large box/bin

## § How to build

- Make the general abdominal model (p. 118) ►. Attach the model to the base (cardboard).
- Make the small bowel loops out of the pink satin fabric instead of the felt. Attach the mesentery (cotton batting) and the mesenteric vessels (blue and red yarn).
- Prepare the large box with several ports for the laparoscopic instruments and camera.
- Optional: add a few pathologies to the model (e.g., appendicular mass [pompom], SB adhesions [using sutures], melanoma, under perfused SB segment [darker color], duodenal perforation).
- Don't forget to add the ligament of Treitz respecting the anatomical relations with the SMA, SMV, duodenum and the pancreatic head. Add the ligament of Treves (ileocecal fold).



Figure 5.23 – Model on the left with liver in the upper left corner (left), trainee running the small bowel (right)

# Open Inguinal Hernia Repair

## § Required Materials

- Felt (red)
- Yarn (blue, red, yellow)
- Fabric (white)
- Penrose (or rubber tube)
- Cardboard
- Cotton batting
- Mesh

## § How to build

- On a piece of a background board, attach 2 small cardboard pieces representing the ASIS and pubic bone.
- Add the internal oblique muscle and transversalis muscle (red felt).
- Connect the inguinal ligament (white fabric) between the ASIS and the pubic bone.
- Make an opening for the internal ring, approximately above the midpoint of the inguinal ligament. Pass the spermatic cord (Penrose with yarn content) and the hernia sac (cotton fabric) through the internal ring.
- Add the iliohypogastric and ilioinguinal nerves at the correct anatomical position.

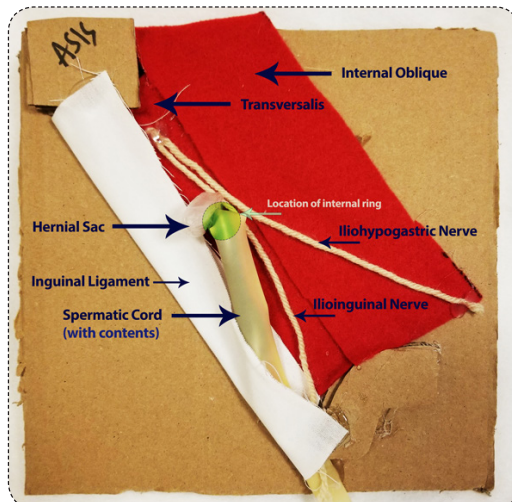


Figure 5.24 – Inguinal Hernia model with structures annotated

# TEP Hernia Repair

## § Required Materials

- Felt (red, blue, yellow, tan)
- Box (e.g., shoe box)
- Yarn (blue, red, yellow)
- Penrose (or rubber tube)
- Mesh

## § How to build

- Cut one side of the box and remove the lid (base, back wall, two sides). Make sure that your box fits the Laparoscopic trainer.
- Add cotton stuffing to the corner of the box between the base and back wall. Line the interior, covering up the cotton, with tan felt.
- Add the midline structures: pubic tubercle and rami (cardboard), bladder (yellow felt), and rectus abdominis (red felt) with Linea Alba (a strip of tan felt).



Figure 5.25 – Inside view of the TEP Model within an FLS trainer

- Add obturator muscles (red felt) and external iliac vessels (red and blue felt) on both sides.
- Add the deep inferior epigastric (artery and 2 veins) and the obturator vessels on both sides.
- Create the iliopubic tracts (one for each side), using the satin fabric make a loop (hollow from inside). Attach one end to the pubic rami and the other end to the side walls angled slightly downward.
- Make the internal ring by cutting a hole in the iliopubic tract (just lateral to the origin of the deep inferior epigastrics). Attach a piece of Velcro to posterior wall inside the tract.
- Now add the testicular arteries, testicular veins, genital and femoral branches of the genitofemoral nerves, and the spermatic cords.

# Ventral Hernia Repair

## § Required Materials

- Felt (pink, red, maroon, orange)
- Headliner (tan)
- Yarn (yellow)
- Sponge
- Velcro
- Large box



Figure 5.26 – Velcro and yellow felt forming adhesions

## § How to build

- Make ports for the camera and the laparoscopic instruments on the sides of the box.
- Cut a large rectangle in the lid of the box. Cover it with the tan headliner from the outside. Mark the belly button on the middle of the headliner.
- Add the sponge pad on the inner side of the lid (abdominal wall). Cover it with red felt except the area that is marked as the umbilicus from the outside. Take out half of the depth of the sponge on that spot and Velcro to it.
- Make a bowel loop with the red and pink felt. Attach the mesentery (yellow felt) on one side. Add Velcro in the middle of the loop on the antimesenteric side.
- To make the adhesions, glue short strings of yellow yarn - of different lengths, in between two pieces of Velcro (one will be attached to the inner side of the abdominal wall and the other one will be attached to the bowel loop).



Figure 5.27 – Small bowel loop attached to the abdominal wall



# Adrenalectomy (Pheochromocytoma)

## § Required Materials

- Felt (maroon, pink, yellow, blue, purple, white, green)
- Yarn (blue, red, yellow)
- Cotton stuffing
- Cotton batting

## § How to build

- Build the basic abdominal model. Attach the adrenals with Velcro.
- Attach 3 arteries and 1 vein to each adrenal.
- The adrenal arteries:
  - The superior adrenal artery branches from inferior phrenic artery.
  - The middle adrenal artery branches directly from the aorta.
  - The inferior adrenal artery branches from the renal artery.
- The adrenal veins:
  - The right adrenal vein drains directly into the IVC.
  - The left adrenal vein joins the left inferior phrenic vein and both drain into the left renal vein.



Figure 5.28 – Adrenalectomy model showing major structures

# Thyroidectomy

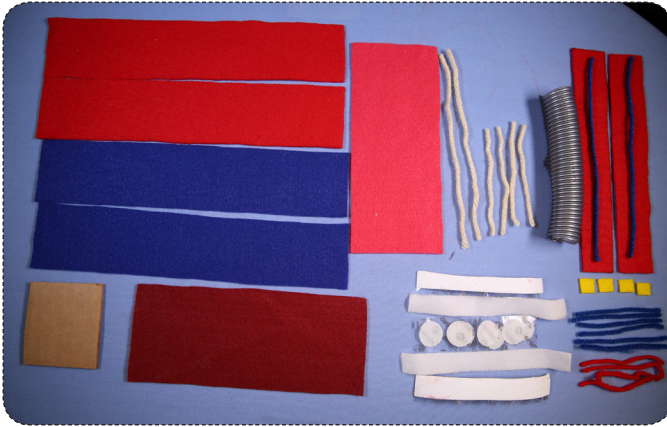


Figure 5.29 – Materials used to build the thyroidectomy model

## § Required Materials

- Felt (maroon, pink, yellow, blue, red)
- Yarn (blue, red, yellow)
- Cotton batting
- Rubber tube

## § How to build

- With a piece of the cardboard, make the base of the model.
- Attach the esophagus (pink: felt tube) to the middle of the board. Attach the trachea (rubber tube) on top of it.
- Add the common carotid arteries and the internal jugular veins on both sides of the trachea. You can use a tube made out of red and blue felt respectively.
- Attach the thyroid cartilage (cardboard) on top of the trachea.
- Make the thyroid gland (red felt) and attach the parathyroid glands (yellow felt) posteriorly. Attach two arteries and three veins to each lobe of the gland.
- Using Velcro, attach the thyroid on top of the trachea, just inferior to the thyroid cartilage.

- Add the recurrent laryngeal nerve (white yarn) at the junction between the trachea and the esophagus on both sides.
- Connect the thyroid vessels (previously attached to the thyroid lobes) to the main vessels as follows:
  - The superior thyroid artery branches from the external carotid and joins the superior pole of the thyroid lobe.
  - The inferior thyroid artery branches from the thyrocervical trunk (a branch of the subclavian artery) and joins the inferior pole of the thyroid lobe.
  - The superior and middle thyroid veins drain into the internal jugular vein.
  - The inferior thyroid vein drains into the brachiocephalic vein.
- Attach the strap muscles of the neck (red felt) on top of the model with the external jugular veins (blue yarn).
- Cover the model with the platysma (thin felt), SubQ fat (cotton fabric), and the skin (headliner).

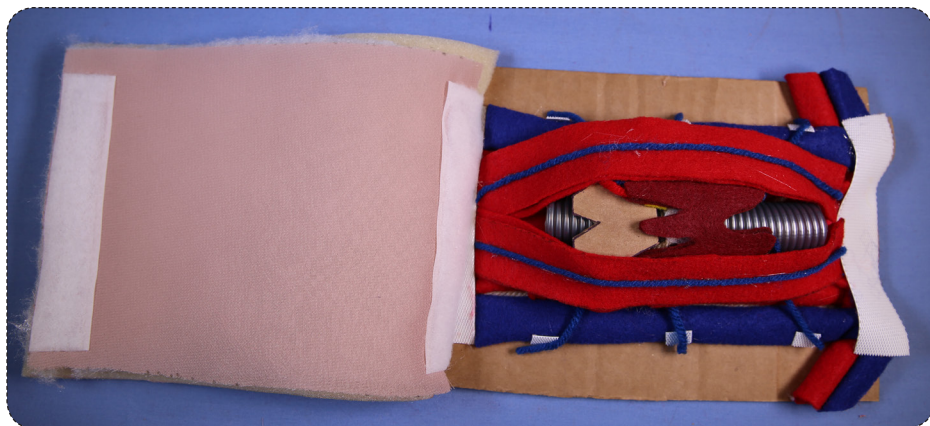


Figure 5.30 – Complete thyroidectomy model with skin layers flipped to the side

## Graham Patch Repair



Figure 5.31 – Model with omentum and stomach detached (left), and attached (right)

### **§ Required Materials**

- Felt (pink, yellow)
- Cotton stuffing

### **§ How to build**

- Cut the shape of the stomach and duodenum out of two layers of the pink felt, filling them with stuffing in between.
- Make a hole (duodenal perforation) on one side of the model.
- Attach the omentum (yellow felt) to the greater curvature of the stomach.

## Colostomy/Ileostomy

### **§ Required Materials**

- Felt (pink, red, yellow, tan)
- Headliner (tan)

### **§ How to build**

- Make a SB loop out of 2 layers of red and pink felt (mucosa and serosa).
- Make the abdominal wall layers out of 20x10 cm rectangular layers ( Skin: tan headliner, yellow: fat, tan: fascia, and red: muscle).



Figure 5.32 – Ileostomy model

# Gastrojejunostomy



Figure 5.33 – GJ Model showing stomach and SB loop

## **§ Required Materials**

- Felt (pink, red, yellow)
- Cardboard
- Cotton stuffing (optional)

## **§ How to build**

- Cut 2 layers of the pink or yellow felt in the shape of the stomach and the proximal jejunum. This will represent the serosa.
- Cut 2 layers of red felt, the mucosa of the stomach, slightly smaller than the mucosa.
- Using the glue gun, attach the outer serosa layers on the outer borders only (make sure that the two mucosa layers are inside).
- Make a bowel loop (mucosa- red felt, serosa- pink felt). Attach the mesentery on one side (yellow felt).
- Attach the stomach and the bowel loops on the card board (the stomach superiorly, and the bowel loop inferiorly).

# Laparoscopic Cholecystectomy

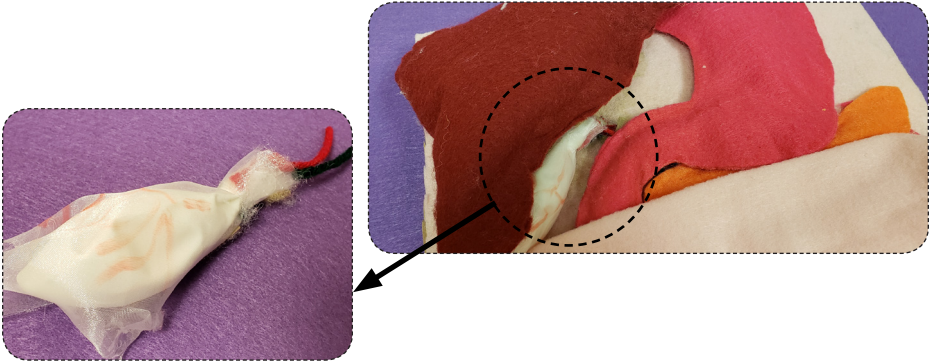


Figure 5.34 – Gallbladder detached (left), wider view the cholecystectomy model (upper right)

## § Required Materials

- Felt (pink, red, maroon, blue, orange, white, green)
- Yarn (red, green, blue, yellow)
- Cotton batting
- Cotton stuffing
- Cardboard
- Large box

## § How to build

- Add holes (ports) to the sides and the top of the box.
- Build the basic abdominal model to fit inside the laparoscopic box.
- Build the gall bladder out of white felt or fabric. Attach it to the inferior surface of the liver with Velcro.
- Add and pay attention to the anatomical relations of the cystic duct, common hepatic duct, CBD, cystic artery, hepatic artery, portal vein.
- Attach the CBD to the second part of the duodenum (posterior-medially) with Velcro.

# Roux-en-Y Gastric Bypass



Figure 5.35 – RYGB model with mesentery intact using Velcro

## § Required Materials

- Felt (pink, hot pink, red, yellow)
- Cardboard
- Cotton stuffing

## § How to build

- Make the distal esophagus, the stomach, the duodenum, jejunum and ileum out of pink felt. Make the colon out of light pink felt.
- Make the omentum out of yellow felt and attach it to the greater curvature of the stomach.
- Make the mesentery out of yellow felt. Attach one side to the small bowel loops and the other side to the base of the model (cardboard).
- Useful tips:
  - Make the gastric pouch and the Roux limb replaceable. Attach them to the model with Velcro.
  - Attach the mesentery of the Roux limb and the mesentery of the biliopancreatic limb with Velcro for easy separation and replacement.



# Yazanoscope

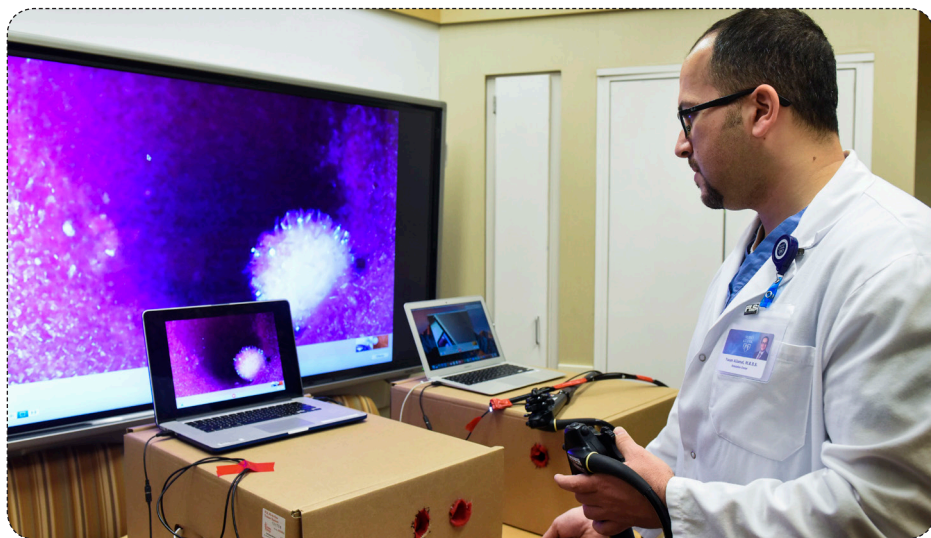


Figure 5.36 – Dr. Yazan AlJamal working on his self-made colonoscope.

The American Board of Surgery (ABS) requires graduating general surgery residents to pass the Fundamentals of Endoscopic Surgery™ (FES) test prior to sitting for the ABS qualifying and certifying examinations.

The FES hands-on skills test is administered using a computer-based endoscopic simulator and consists of 5 different tasks. The computer simulator itself costs over \$150,000 and very few institutions can afford this simulator.

To overcome the prohibitive costs of a computer simulator and allow our learners to practice in a safe environment, we created a functioning simulation endoscope (the Yazanoscope) and an inexpensive box model of the colon and stomach.

## § Materials

1. Non-functioning discarded colonoscope or endoscope
2. Wireless HD camera
3. Zip ties
4. Adhesive tape
5. Vacuum hose
6. Cardboard box
7. Felt (red)
8. Glue gun
9. Plywood sheet

With adhesive tape and plastic zip ties (\$1US) the endoscopic camera is fixed to the tip of the endoscope and aligned with the camera to the same side of the original non-functioning colonoscopy camera. A piece of adhesive tape covers the sharp edge of the plastic zip ties. The camera wire is wrapped and fixed around the scope using adhesive tape. The camera is plugged into the Wi-Fi generator box. Any wireless-enabled computer device (e.g., smartphone, PC) can then connect to the camera, to monitor or record the training activity.

We have used an HD endoscopy app (free from Apple App Store™/ Google Play™) with a smartphone to allow trainees or instructors to observe and record endoscopic videos.



Figure 5.37 – Vacuum hose (left), colonoscope with an HD camera attached to the tip (right)

## § How to build

1. Two plywood sheets are cut to fit inside two cardboard boxes, 25×30×40 cm in size.



Figure 5.38 – Cardboard box (left), plywood sheet (right)

2. Using scissors, cut the vacuum hose (all the way) longitudinally.



Figure 5.39 – Vacuum hose split longitudinally

3. Glue red felt to the inside of the hose. Mucosal folds can be created by folding the felt circumferentially inside the vacuum hose every 10 cm.



Figure 5.40 – Gluing the felt into the hose (left & middle), creating mucosal folds (right)

4. Six and five 20-mm fluffy balls were glued 10 cm apart inside colon.



5. Close the colon (vacuum hose) using zip ties, then fix them to the plywood sheet at a distance of about 5-10 cm from each other.

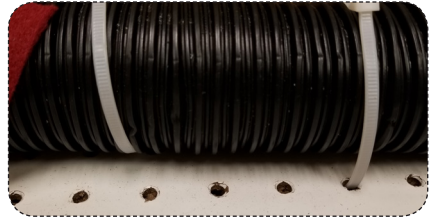


Figure 5.41 – Vacuum hose tied around and down onto the plywood sheet using zip ties

6. After closing the box, a 2.5 cm opening was created to introduce the scope and a small piece of red felt was glued around the hole to represent the anus.



Figure 5.42 – Creating an opening on the side of the box to represent the anus



# X-Boxes



|                |       |
|----------------|-------|
| Release Vacuum |       |
| Draw Needle    |       |
| Orange         | (0-2) |
| Needle         | (0-2) |
| File           | (0-2) |
| 2              |       |
| 24             | (0-2) |

In this chapter we provide instructions along with visual aids for creating the practice kits (X-Boxes) that we make available to learners at all times. Surgical residents utilize these X-Boxes in order to prepare for either the Surgical Olympics or Surgical X-Games. They also use these kits for personal skills practice and repetitions that they can do in the convenience of their own home.

## X-Box List

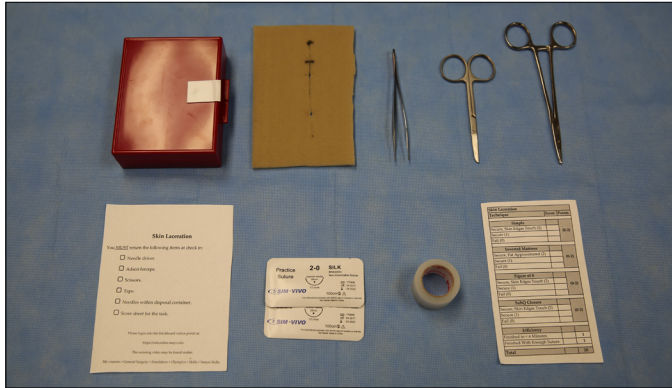
- |                               |                         |
|-------------------------------|-------------------------|
| 1. Skin Closure/Suturing      | 7. Hepaticojejunostomy  |
| 2. Fascial Closure            | 8. Gastrojejunostomy    |
| 3. Mastectomy Drain Placement | 9. Pancreatojejunostomy |
| 4. Small Bowel Anastomosis    | 10. Abdominal Anatomy   |
| 5. Cricothyrotomy             | 11. Neck Anatomy        |
| 6. Chest Tube Placement       | 12. Groin Anatomy       |

All boxes contain the **corresponding model** and a **score sheet** to aid in self-evaluation and assessment.



Figure 6.1 – Chest tube placement X-Box

# 1. Skin Closure/Suturing

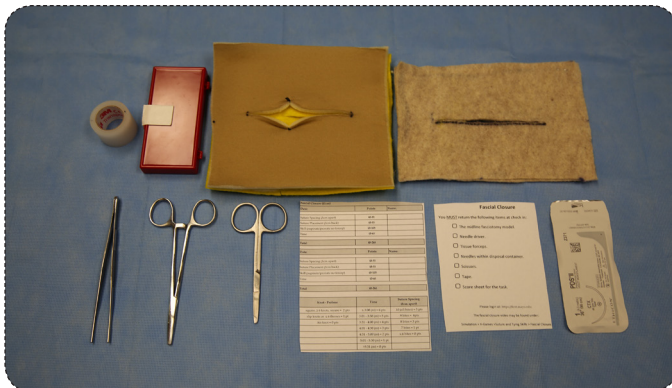


## • Components

- (1) Needle driver
- (1) Adson forceps
- (1) Scissors
- (1) Roll of tape
- (1) Needle disposal box
- (1+) Silk suture
- (1) Skin closure model



# 2. Fascial Closure

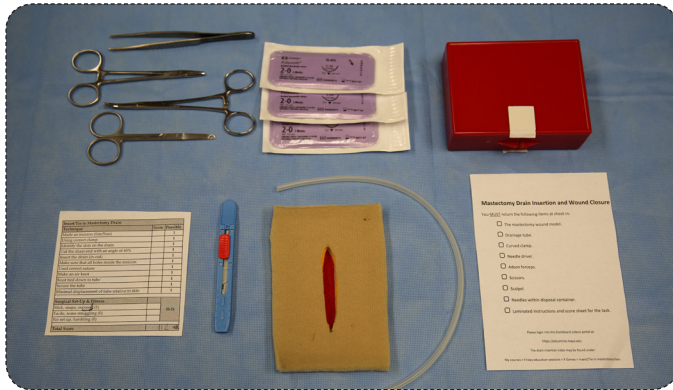


## • Components

- (1) Needle driver
- (1) Adson forceps
- (1) Syringe
- (1) Roll of tape
- (1) Needle disposal box
- (1) PDS suture



### 3. Mastectomy Drain Placement



#### • Components

- (1) Silastic tube
- (1) Needle driver
- (1) Adson forceps
- (1) Mastectomy drain model
- (1) Scissors
- (1) Needle disposal box
- (1+) Nylon suture



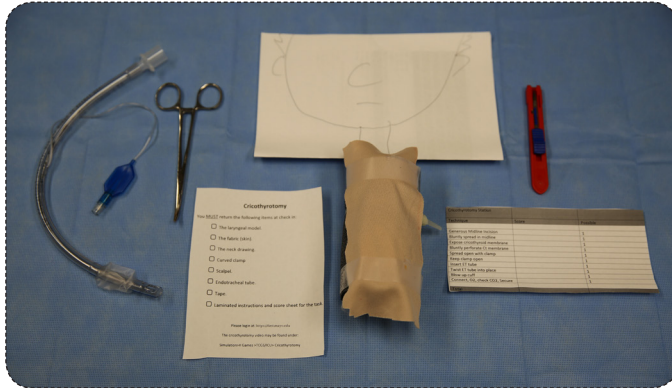
### 4. Small Bowel Anastomosis



#### • Components

- (2) Needle drivers
- (1) Adson forceps
- (1) Scissors
- (1) SB model
- (2) Mosquito clamps
- (1) Roll of tape
- (1) Needle disposal box
- (2) Silk & Vicryl suture

## 5. Cricothyrotomy



### • Components

- (1) Cricothyrotomy model
- (1) Curved clamp
- (1) Scalpel
- (1) Silk suture
- (1) Score sheet



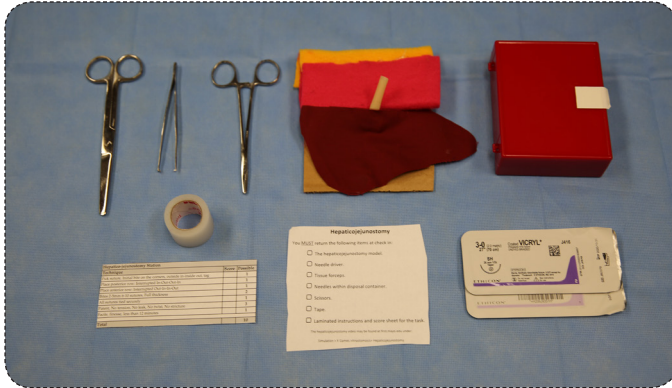
## 6. Chest Tube Placement



### • Components

- (1) Chest Tube
- (1) Needle driver
- (1) Adson forceps
- (1) Kelly clamps
- (1) Chest wall model
- (1) Scissors
- (1) Scalpel
- (1) Needle disposal box
- (2+) Silk suture

## 7. Hepatojejunostomy

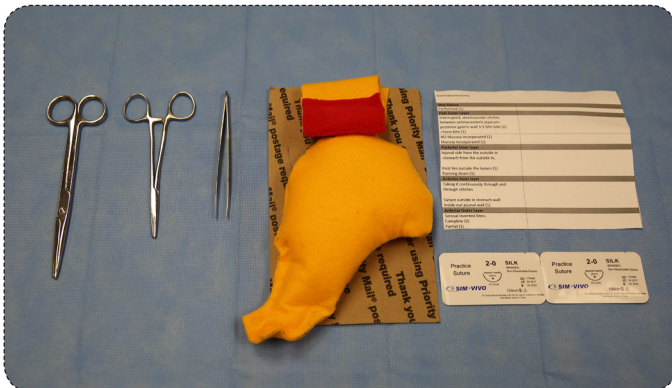


### • Components

- (1) Needle driver
- (1) Adson forceps
- (1) Scissors
- (1) HJ model
- (1) Roll of tape
- (1) Needle disposal box
- (2) Vicryl suture



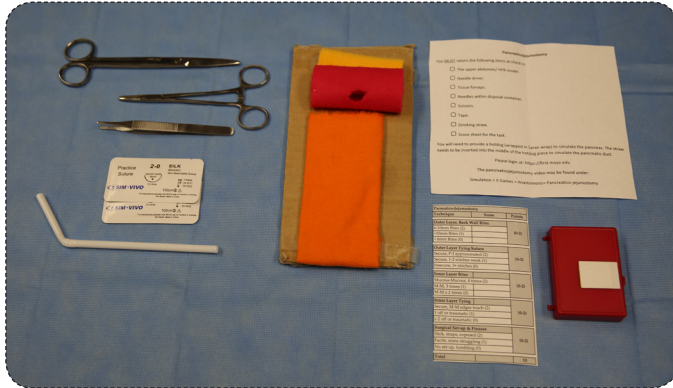
## 8. Gastrojejunostomy



### • Components

- (1) Needle driver
- (1) Adson forceps
- (1) Scissors
- (1) Needle disposal box
- (2) Silk suture
- (1) GJ model

## 9. Pancreatojejunostomy



- **Components**

- (1) Straw
- (1) Needle driver
- (1) Adson forceps
- (1) PJ model
- (1) Scissors
- (1) Needle disposal box
- (2) Silk suture
- **[Learner supplies hotdog]**



## 10. Abdominal Anatomy



- **Components**

- (1) Abdominal anatomy model
- (1) Score sheet

## 11. Neck Anatomy



- **Components**

- (1) Neck anatomy model
- (1) Score sheet
- (1) Ziploc bag



## 12. Groin Anatomy



- **Components**

- (1) Groin anatomy model
- (1) Score sheet
- (1) Ziploc bag



# Appendix



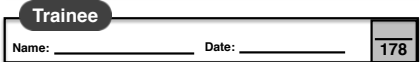
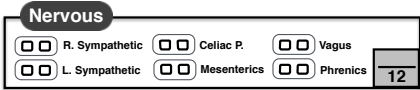
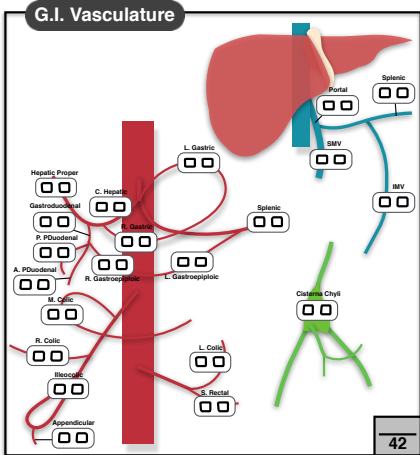
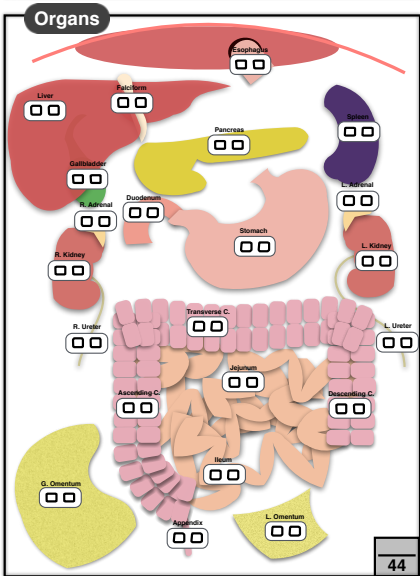
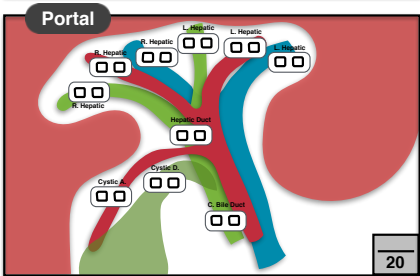
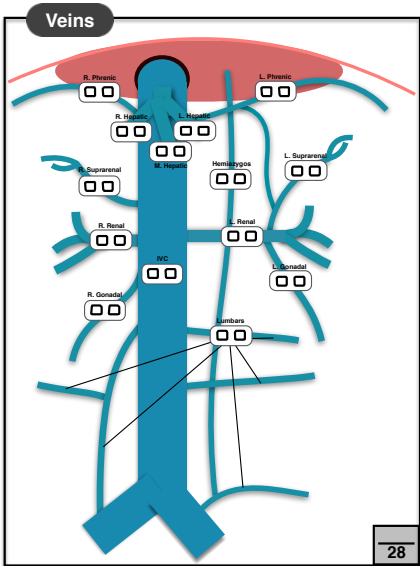
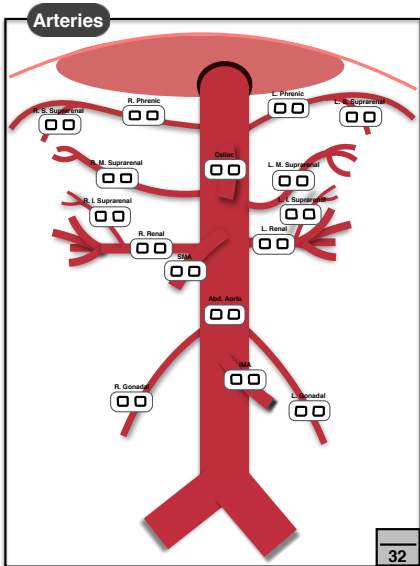
Here we provide the scoring sheets for all skill stations that are used for the Surgical Olympics. Other anatomy scoring sheets are included as well.

## Scoring Sheets

|  |     |
|--|-----|
| • <b>Surgical Olympics Skills</b>            |     |
| – Abdominal Anatomy                          | 160 |
| – Central Line & Tube Thoracostomy           | 163 |
| – Fascial Closure                            | 163 |
| – FES  | 164 |
| – FLS (Knot tying, Circle cut, Peg transfer) | 165 |
| – Knot Tying (Dowel & Balloon)               | 166 |
| – Suturing/Skin Closure                      | 167 |
| – Trauma station (Cricothyrotomy)            | 167 |
| • <b>Other</b>                               |     |
| – Groin Anatomy                              | 161 |
| – Neck Anatomy                               | 162 |



# Abdominal Anatomy



# Groin Anatomy

Pre-Peritoneal

Preperitoneal Fat

Deep Inf. Epigastric Vein

Gonadal vessels

External Iliac Artery

Transversalis Fascia

Internal Ring

External Iliac Vein

Obturator Artery

Obturator Vein

Femoral Nerve

Artery of Cremaster Muscles

Pampiniform Plexus

Genital Branch of GF Nerve

Artery of Vas Deferens

Vas Deferens

Testicular Artery

34

Transverse

Transversus abdominus

Transversus abdominus Muscle

Ilioinguinal nerve

Femoral Canal

Lateral Femoral Cutaneous Nerve

Lucunar Ligament

Rectus Abdominus

14

Internal

Internal Oblique Muscle

Internal Oblique Fascia

Iliohypogastric Nerve

Cremaster Muscle

Conjoined Tendon

10

External

External Oblique Muscle

Superficial Epigastric Artery

External Oblique Fascia

Linea Alba

Superficial Epigastric Vein

Spermatic cord

Inguinal/Poupart's Ligament

External Ring

16

Misc.

Pubic Symphysis

ASIS

Skin

Pubic Bone

Ischium

Scarpa's Fascia

Fat/Campers Fascia

Peritoneum

Cooper's Ligament

Lymph Node

20

Trainee

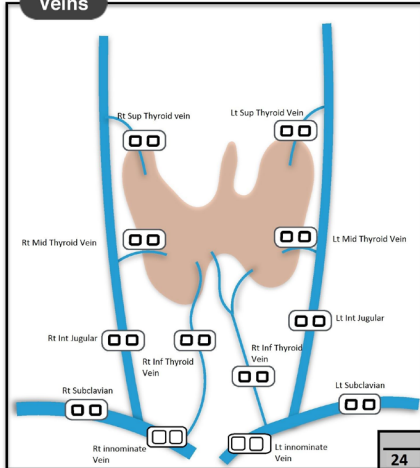
Name: \_\_\_\_\_

Date: \_\_\_\_\_

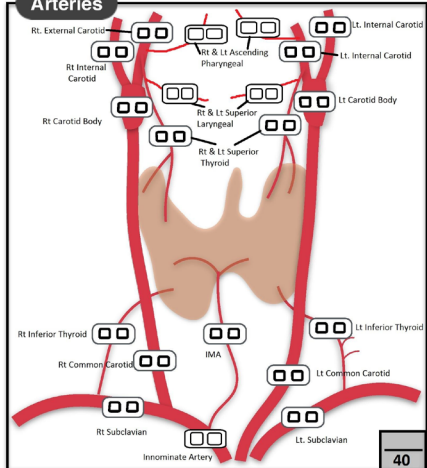
94

# Neck Anatomy

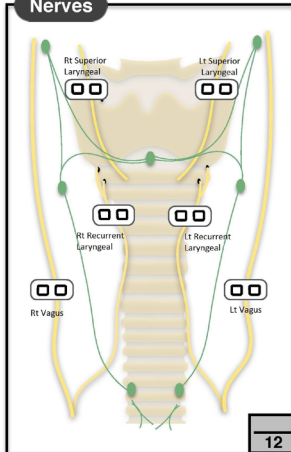
## Veins



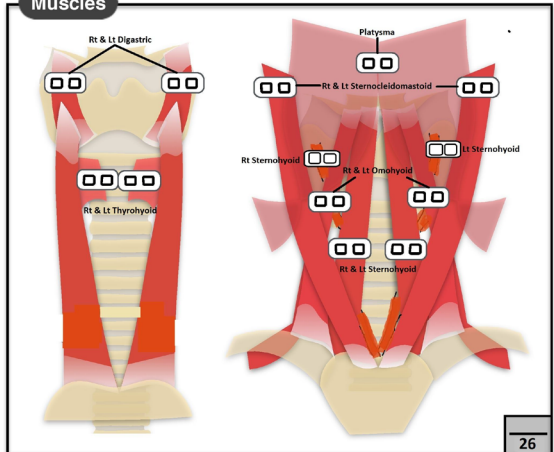
## Arteries



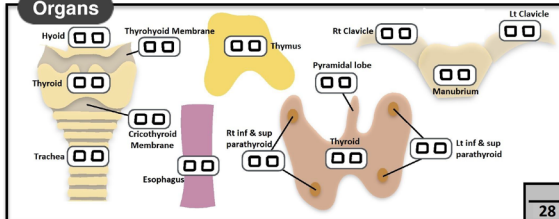
## Nerves



## Muscles



## Organs



## Misc.

- ☐ R. Ext. Jugular
  - ☐ L. Ext. Jugular
  - ☐ Lymph Nodes
  - ☐ Skin
  - ☐ Adipose
- 10

## Trainee

Name: \_\_\_\_\_

Date: \_\_\_\_\_

140

## Central Line Placement

| <u>Name</u>                | <u>Points</u> | <u>Name</u> | <u>Name</u> |
|----------------------------|---------------|-------------|-------------|
| Probe Completely on Skin   | 0 - 2         |             |             |
| Vessels oriented           | 0 - 1         |             |             |
| Needle tip visualized      | 0 - 2         |             |             |
| No past pointing of needle | 0 - 2         |             |             |
| Speaks clearly & audibly   | 0 - 1         |             |             |
| Words educational          | 0 - 2         |             |             |
| <b>TOTAL</b>               | <b>0 - 10</b> |             |             |

## Tube Thoracostomy

|                                      | <u>Points</u> | <u>Name:</u> | <u>Name:</u> |
|--------------------------------------|---------------|--------------|--------------|
| Correct Insertion Site               | 1             |              |              |
| Prep If Available                    | 1             |              |              |
| 2-3cm Transverse Incision            | 1             |              |              |
| Blunt Dissection of Subcut.          | 1             |              |              |
| Parietal Pleura Puncture             | 1             |              |              |
| Finger                               | 1             |              |              |
| Placement With Clamped, Proximal End | 1             |              |              |
| <b>Total</b>                         | <b>7</b>      |              |              |

## Fascial Closure

| <u>Fascial Closure (11cm)</u>           |                         |                              |                                     |                                   |                                       |
|---|-------------------------|------------------------------|-------------------------------------|-----------------------------------|---------------------------------------|
| <u>Date:</u>                            | <u>Points</u>           | <u>Name:</u>                 | <u>Name:</u>                        |                                   |                                       |
| Suture Spacing (1cm apart)              | (0-5)                   |                              |                                     |                                   |                                       |
| Suture Placement (1cm back)             | (0-5)                   |                              |                                     |                                   |                                       |
| Skills (supinate/pronate, needle touch) | (0-10)                  |                              |                                     |                                   |                                       |
| Time                                    | (0-6)                   |                              |                                     |                                   |                                       |
| <b>Total</b>                            | <b>(0-26)</b>           |                              |                                     |                                   |                                       |
|   | <u>Time</u>             | <u>Bite Depth (1cm deep)</u> | <u>Travel b/w Bites (1cm apart)</u> | <u>Skill (N = needle touches)</u> | <u>Skill (N = incorrect rotation)</u> |
|   | ≤ 3:00 (m) = 6 pts      | 20 (all bites) = 5 pts       | 20 (all bites) = 5 pts              | N untouched = 5 pts               | N all correct = 5 pts                 |
|   | 3:01 - 3:30 (m) = 5 pts | 18 bites = 4 pts             | 18 bites = 4 pts                    | N touched 1-4x = 4 pts            | N incorrect 1-4x = 4 pts              |
|   | 3:31 - 4:00 (m) = 4 pts | 16 bites = 3 pts             | 16 bites = 3 pts                    | N touched 5-8x = 3 pts            | N incorrect 5-8x = 3 pts              |
|   | 4:01 - 4:30 (m) = 3 pts | 14 bites = 1 pt              | 14 bites = 1 pt                     | N touched 9-12x = 2 pts           | N incorrect 9-12x = 2 pts             |
|   | 4:31 - 5:00 (m) = 2 pts | ≤ 12 bites = 0 pts           | ≤ 12 bites = 0 pts                  | N touched 13+ = 0 pts             | N incorrect 13+ = 0 pts               |
|   | 5:01 - 5:30 (m) = 1 pt  |                              |                                     |                                   |                                       |
|   | >5:31 (m) = 0 pts       |                              |                                     |                                   |                                       |

## FES station

| Name:              |   |  |       |              |
|--------------------|---|--|-------|--------------|
|                    | Skills  | Conversion   | Score | Total Points |
| DESCRIPTION RESULT | Total Insertion Time (to the cecum)   | < 4:00 min = 3<br>4:00-5:00 min =2<br>5:00-6:00 = 1<br>> 6:00 = 0      |       | 3            |
|                    | Max depth of scope insertion  | < 60 cm = 0<br>60-80 cm = 2<br>80-110 cm = 3<br>> 110 = 0              |       | 3            |
|                    | Colonic Perforation   | No = 1<br>Yes= -5  |       | 1            |
|                    | Retroflexion performed in the rectum  | Yes = 1<br>No = 0  |       | 1            |
|                    | % of the colon mucosa visulaized  | < 85 % = 0<br>>85 = 1<br>90 - 91 % = 2<br>92 % - 95% = 3<br>> 95 % = 4 |       | 4            |
| Patient Comfort    | Level of discomfort<br>No pain > 98%<br>No pain 95-98%<br>No pain 90-95%<br>No pain 87-90%<br>No pain < 87% | 4<br>3<br>2<br>1<br>0  |       | 4            |
| Addl. Metrics      | Patient experienced vasovagal reaction  | Yes = 0<br>No = 1  |       | 1            |
| Visualization      | Visulaization: % of time in red-out   | > 15 % = 0<br>10-15 % = 1<br>5-10 % = 2<br>< 5% = 3                    |       | 3            |
| Total              |   |  |       | 20           |

## FLS stations

### FLS CIRCLE CUT

| Resident | Max Outside | Max Inside | Time (0:00) |
|----------|-------------|------------|-------------|
|          |             |            |             |
|          |             |            |             |
|          |             |            |             |
|          |             |            |             |

### FLS KNOT TYING

| Resident | Air Knot?<br>(Y or N) | Secure?<br>(1 or 2 dots) | Time (0:00) | Affix knots below |  |
|----------|-----------------------|--------------------------|-------------|-------------------|--|
|          |                       |                          |             |                   |  |
|          |                       |                          |             |                   |  |
|          |                       |                          |             |                   |  |
|          |                       |                          |             |                   |  |

### FLS PEG TRANSFER

| Resident | Time (:_:_) | Dropped Discs | Discs out of field |
|----------|-------------|---------------|--------------------|
|          |             |               |                    |
|          |             |               |                    |
|          |             |               |                    |
|          |             |               |                    |



# Knot Tying

| Open KNOTS |            |           |           |                   |
|------------|------------|-----------|-----------|-------------------|
| Resident   | Time (sec) |           |           | Affix knots below |
|            | R<br>hand  | L<br>hand | 2<br>hand |                   |
|            |            |           |           |                   |
|            |            |           |           |                   |
|            |            |           |           |                   |
|            |            |           |           |                   |

|                             |                |       |       |
|-----------------------------|----------------|-------|-------|
|                             |                | Name: | Name: |
| <b>Time:</b>                | <b>Points:</b> |       |       |
| <18 sec                     | 3              |       |       |
| 19-24 sec                   | 2              |       |       |
| 25-29 sec                   | 1              |       |       |
| ≥30 sec                     | 0              |       |       |
| <b>Leak:</b>                |                |       |       |
| No leak                     | 3              |       |       |
| With pressure               | 1              |       |       |
| With no pressure            | 0              |       |       |
| <b>Accuracy:</b>            |                |       |       |
| On lines                    | 3              |       |       |
| 1 mm away from 1 or 2 lines | 2              |       |       |
| 2 mm away from 1 or 2 lines | 1              |       |       |
| 3 mm away from 1 or 2 lines | 0              |       |       |
| <b>Square Knot?</b>         |                |       |       |
| Yes                         | 1              |       |       |
| No                          | 0              |       |       |
| <b>Total:</b>               | 10             |       |       |

Balloon  
Knot Tying

|           |  |  |
|-----------|--|--|
| T1:       |  |  |
| Time:     |  |  |
| Leak:     |  |  |
| Accuracy: |  |  |
| Square:   |  |  |
| T2:       |  |  |
| Time:     |  |  |
| Leak:     |  |  |
| Accuracy: |  |  |
| Square:   |  |  |
| T3:       |  |  |
| Time:     |  |  |
| Leak:     |  |  |
| Accuracy: |  |  |
| Square:   |  |  |

## Skin Closure

| Technique                    | Points | Name | Name |
|------------------------------|--------|------|------|
|                              |        |      |      |
| Simple                       | (0-2)  |      |      |
| Secure, Skin Edges Touch (2) |        |      |      |
| Secure (1)                   |        |      |      |
| Fail (0)                     |        |      |      |
|                              |        |      |      |
| Vertical Mattress            | (0-2)  |      |      |
| Secure, Fat Approximated (2) |        |      |      |
| Secure (1)                   |        |      |      |
| Fail (0)                     |        |      |      |
|                              |        |      |      |
| Figure of 8                  | (0-2)  |      |      |
| Secure, Skin Edges Touch (2) |        |      |      |
| Secure (1)                   |        |      |      |
| Fail (0)                     |        |      |      |
|                              |        |      |      |
| SubQ Closure                 | (0-2)  |      |      |
| Secure, Skin Edges Touch (2) |        |      |      |
| Secure (1)                   |        |      |      |
| Fail (0)                     |        |      |      |
|                              |        |      |      |
| Efficiency                   |        |      |      |
| Finished in < 6 Minutes      | 1      |      |      |
| Finished With Enough Suture  | 1      |      |      |
|                              |        |      |      |
| Total                        | 10     |      |      |

## Trauma (Cricothyrotomy)

| Cricothyrotomy |                                 | Name |           |   |
|----------------|---------------------------------|------|-----------|---|
| 1              | Palpate Landmarks               |      |           |   |
| 2              | Generous Incision               |      |           |   |
| 3              | Bluntly spread in midline       |      |           |   |
| 4              | Expose cricothyroid membrane    |      | 0-1 fact  | 0 |
| 5              | Perforate cricothyroid membrane |      | 2-3 facts | 1 |
| 6              | Spread open with clamp          |      | 3-4 facts | 2 |
| 7              | Keep clamp open                 |      | 4+ skill  | 3 |
| 8              | Twist & Insert ET tube          |      | 5+ skill  | 4 |
| 9              | Blow up cuff                    |      | 7+ skill  | 5 |
| 10             | Connect O2, check CO2, Secure   |      |           |   |
| <b>TOTAL:</b>  |                                 |      |           |   |

*The "HOW TO" Book of Low Cost Surgical Simulation*

**2018**