FUNDAMENTALS OF LAPAROSCOPIC SURGERY™

Technical Skills Proficiency-Based Training Curriculum

Members of the SAGES FLS committee have developed this curriculum for use in residency training programs as a way to prepare for the FLS manual skills test. The training curriculum is proficiency based, whereby trainees are oriented to the materials and perform self-practice until expert-derived performance levels are reached. Residents may practice as much or as little as needed in order to acquire the skills incorporated into the FLS exam. This protocol has been shown to correlate with a uniform successful passing score according to the FLS technical skills testing criteria. We recommend this curriculum for all resident levels. Interns may benefit from mastering these skills early in their training, such that they are better prepared for opportunities in the operating room and can undergo additional training throughout their residency as needed. Similarly, using the curriculum with mid-level and senior residents will help ensure that all trainees have suitable skills to perform a wide array of laparoscopic procedures.

I. OVERVIEW OF TRAINING AND TESTING

A trainee should first be introduced to the FLS skills tasks by viewing the video tutorials, which can be found in module five of the FLS online didactics. The FLS Manual Skills Guidelines, available on the FLS website www.flsprogram.org, can be used to reference the instructions and parameters for each of the five skills tasks. Pre- and post-testing is recommended so that performance improvement can be tracked. Training can be done with or without coaching (some periodic coaching may be helpful, but is not necessary), as trainees are encouraged to rely heavily upon the video tutorials in a self-study fashion, thus minimizing the need for personnel resources.

The materials used for Task 1 (Peg Transfer), Task 4 (Suture with Extracorporeal Knot), and Task 5 (Suture with Intracorporeal Knot) in the FLS Exam and in this training curriculum are identical. Materials for Task 2 (Precision Cutting) and Task 3 (Ligating Loop) have been modified for training as detailed here.

The training gauze used in Task 2 is marked with two concentric circles, whereas the testing gauze has a single circular mark. This modification was necessary because the scoring system for the testing gauze does not lend itself to real-time evaluation. The double-circle training gauze should ONLY be used in training and the single-circle gauze is the ONLY gauze allowed for testing. When the double-circle gauze is used, ALL cuts must be made within the white space between the two circles. Any cut that deviates into either circle represents a violation of the error parameter of the proficiency-based curriculum.

For Task 3, trainees may only use reusable ligating loops in the training environment. The single use ligating loops are the ONLY ligating loops suitable for testing. When utilizing a reusable ligating loop, trainees should use a Maryland Dissector to simulate cutting the ligating loop at the end of the task. The knot on the reusable ligating loop can then be loosened and slid back to its original location so that the ligating loop may be used again.

The training score sheet (found at the end of this document) and materials as described above should be used within the context of the proficiency-based curriculum (reaching proficiency levels according

to the specified protocol). The proficiency levels were derived from the mean performance of two experts who performed five repetitions of each task; the data were suitably homogeneous as there were no outliers (> 2 s.d. beyond the mean) and no trimming was required. These expert-derived performance levels have been tested in a multi-institutional fashion and have been determined to be suitable endpoints for training, as they were uniformly achievable with practice for novices without prior operative exposure. Moreover, following this proficiency-based curriculum, all trainees successfully passed the skills portion of the FLS exam. Note the data reported regarding time allocation and resources needed are for complete novices; less time and fewer resources may be required for more advanced learners or individuals with prior simulator experience. The goal of this curriculum is to teach trainees FLS laparoscopic skills in an effective and efficient format, in order to achieve a 100% pass rate on the FLS skills test.

The written portion of the FLS program can be taught using the FLS online didactics and is not covered in the scope of this skills curriculum although FLS certification requires mastery of the cognitive material as well.

II. INTRODUCTION AND PRE-TEST (RECOMMENDED)

Objective

Familiarize all trainees with the FLS trainer box, supplies, setup, instrumentation, FLS Manual Skills Guidelines, and online video tutorials as well as to establish and document a trainee's baseline performance.

Introduction

Each trainee watches the videos contained in module five of the FLS online didactics for all 5 tasks.

Pre-test

1. Each trainee watches each task on FLS online module five immediately prior to testing.
2. Each trainee performs one repetition of Task 1 immediately following the viewing of the video and records it on the training scoresheet.
3. Repeat steps 1 and 2 above for the remaining four tasks until each trainee has performed one repetition of all five tasks, in order (Task 1, then Task 2, then Task 3, etc.).

Time requirements

15 minutes for Introduction, 45 minutes for the pre-test, one hour total.

Personnel Requirements

One hour per trainee. Pre-test can be administered by a skills lab technician, skills/sim lab instructor, or residency program director.

Materials

FLS online didactics (module five), FLS trainer box with connected monitor, required instruments and supplies, stopwatch, and training scoresheets.

Timing

The Introduction and Pre-test should be conducted prior to training.

III. TRAINING

Objective

For all trainees to practice a sufficient amount to demonstrate proficiency for all tasks.

Training Protocol and Proficiency Levels

Training should be performed in a self-study fashion with a heavy reliance on the video tutorials. Additional feedback may be given on an as-needed basis, especially if a trainee is having difficulty achieving the proficiency levels. Performance should be monitored by regularly reviewing the progress of each trainee. Each trainee should practice each of the five tasks in order (Task 1 until proficiency is achieved, then Task 2, then Task 3, etc.). The performance of each repetition can be recorded using the included training scoresheet or using a spreadsheet of one's own creation. FLS-approved training supplies (including double-circle gauze for Task 2 and reusable ligating loops for Task 3) should be used. Proficiency-based training should be conducted using the performance levels and the protocol listed below.

Task 1: Peg Transfer

The task should be practiced until it can be performed in 48 seconds with no objects dropped outside of the field of view. This level of performance should be achieved on two consecutive repetitions and then again on 10 more nonconsecutive repetitions for reinforcement. If a trainee cannot achieve this level of performance in 80 repetitions, that trainee should proceed to Task 2.

Task 2: Precision Cutting

The task should be practiced until it can be performed in 98 seconds with all cuts made within the section between the two lines of the training gauze. This level of performance should be achieved on two consecutive repetitions or for a maximum of 80 repetitions.

Task 3: Ligating Loop

The task should be practiced until it can be performed in 53 seconds with up to 1mm accuracy errors. This level of performance should be achieved on two consecutive repetitions or for a maximum of 80 repetitions.

Task 4: Suture with Extracorporeal Knot

The task should be practiced until it can be performed in 136 seconds with up to 1mm accuracy errors. This level of performance should be achieved on two consecutive repetitions or for a maximum of 80 repetitions.

Task 5: Suture with Intracorporeal Knot

The task should be practiced until it can be performed in 112 seconds with up to 1mm accuracy errors. This level of performance should be achieved on two consecutive repetitions and then again on 10 more nonconsecutive repetitions for reinforcement or for a maximum of 80 repetitions.

The proficiency levels and the training protocol are summarized in the table below.

Task	Task Name	Proficiency Level*	Seconds	Allowable Errors	Repetitions**
1	Peg Transfer	mean	48	no drops outside field of view	2 consecutive + 10 nonconsecutive
2	Precision Cutting	mean + 2 s.d.	98	all cuts between 2 circles of the training gauze	2 consecutive
3	Ligating Loop	mean + 2 s.d.	53	up to 1mm accuracy error allowed	2 consecutive
4	Suture with Extracorporeal Knot	mean + 2 s.d	136	up to 1 mm accuracy error allowed	2 consecutive
5	Suture with Intracorporeal Knot	mean + 2 s.d.	112	up to 1mm accuracy error allowed	2 consecutive +10 nonconsecutive

*Based on expert-derived performance
**Maximum number of repetitions is 80

Training Schedule

For optimal benefit, training should be conducted in a distributed fashion with a maximum duration of one to one and a half hours per session. A maximum of two sessions per day may be conducted, but additional training during a single day should be avoided in order to minimize fatigue. Ideally, one-hour training sessions may be held up to several times per week and conducted for as long as necessary to complete the curriculum.

Training Duration

Since this is a proficiency-based curriculum, the duration of training will vary, as individuals will have variable levels of prior experience and will achieve proficiency at different rates. For complete novices, skill acquisition requires, on average, 10 hours of practice with a range of 6-14 hours. For more advanced trainees, less time may be needed. A sign-in log may be helpful to track training duration.

Number of Repetitions and Materials

Similar to training duration, the number of repetitions to reach proficiency will vary according to individual rates of skill acquisition. Listed below are the mean number of repetitions required to demonstrate proficiency according to the protocol described above, along with the range in parentheses. These data are for complete novices and fewer repetitions may be required for more advanced trainees. These data may assist the instructor in allotting sufficient consumable materials including training gauze for Task 2, reusable ligating loops for Task 3, and suture for Tasks 4 & 5. With regard to reusable materials, Task 1 requires the Peg Transfer model which can be used repetitively without replacement, Task 2 only requires replacement of the training gauze, Task 3 requires replacement of the foam model after approximately 25 repetitions and replacement of the reusable ligating loop after approximately 10 repetitions. Tasks 4 & 5 require replacement of the Penrose drain and suture after approximately 10-15 repetitions provided the suture is not cut during the task. Sufficient laparoscopic instrumentation should be on hand as well so that malfunctioning equipment may be easily replaced.

Task 1	Task 2	Task 3	Task 4	Task 5	TOTAL
57 (26-80)	18 (4-31)	8 (2-36)	7 (3-14)	28 (15-52)	119 (66-161)

IV. POST-TEST (RECOMMENDED)

Objective
Document final performance.

Post-test
Post-testing is recommended in order to track improvement but is optional.

1. Each trainee performs one repetition of each of the five tasks with each repetition recorded on the training scoresheet (found at the end of this document).

Time Requirements
30 minutes per trainee

Personnel Requirements
The post-test can be administered by a skills lab technician, skills/sim lab instructor, or residency program director.

Materials
FLS Manual Skills Guidelines, FLS trainer box and connected monitor, required laparoscopic instrumentation and supplies, stopwatch, and training scoresheet.

Timing
The post-test should be conducted after documented completion of the training curriculum.

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FLS Skills Training Scoresheet

Date:	
Trainee:	

Follow the instructions for each task using the videos in module 5 of the FLS online didactics

Peg Transfer Task		
Equipment	2 Maryland Dissectors, peg board, 6 rubber objects	Trainee Performance
Timing starts	First object is touched	_____ min _____ seconds _____ #of object dropped outside field of view
Timing stops	Last object is released	
Proficiency level	Completed in 48 seconds with no objects dropped outside the field of view	

Precision Cutting Task		
Equipment	1 Maryland Dissector, 1 pair endoscopic scissors/shears, jumbo clip, 1 double-circle gauze piece	Trainee Performance
Timing starts	Gauze is touched	_____min _____seconds All cuts within the lines? YES NO
Timing stops	Circle is release from gauze frame	
Proficiency level	Completed in 1 minute 38 seconds, all cuts within the two marked circles	

Ligating Loop Task		
Equipment	1 Maryland Dissector OR 1 locking grasper, 1 pair endoscopic scissors/shears, 1 reusable ligating loop, 1 jumbo clip, 1 red foam organ	Trainee Performance
Timing starts	First instrument enters field of view	_____min _____seconds Loop is secure? YES NO Loop is _____mm away from mark on appendage
Timing stops	End of suture material is cut (simulated using Maryland Dissector instead of scissors)	
Proficiency level	Completed in 53 seconds, loop is securely around appendage. Loop is within 1mm of the marked line	

Extracorporeal Knot Task		
Equipment	1 Maryland Dissector and 1 laparoscopic needle driver OR 2 laparoscopic needle drivers (cannot be self-righting), 1 knot pusher (open or closed), 1 pair endoscopic scissors/shears, 1 90cm silk suture (SH needle), 1 Penrose drain, 1 suture block	Trainee Performance
Timing starts	First instrument enters field of view	_____min _____seconds Knot is secure? YES NO Slit in drain is closed? YES NO Suture is _____mm away from dots Drain was avulsed from foam block? YES NO
Timing stops	Both ends of suture material are cut	
Proficiency level	Completed in 2 minutes, 16 seconds, suture entered in Penrose drain within 1mm of the dots, slit in drain is closed, knot is secure (not slipping, no air knots).	

Intracorporeal Knot Task		
Equipment	2 laparoscopic needle drivers (cannot be self-righting), 1 pair endoscopic scissors/shears, 1 15cm silk suture (SH needle), 1 Penrose drain, 1 suture block **reuse suture from previous task and cut down to 15 cm*	Trainee Performance
Timing starts	First instrument enters field of view	_____min _____seconds Knot is secure? YES NO Slit in drain is closed? YES NO Suture is _____mm away from dots Drain was avulsed from foam block? YES NO
Timing stops	Both ends of suture material are cut	
Proficiency level	Completed in 1 minute 52 seconds, suture entered in Penrose drain within 1 mm of the dots, slit in drain is closed, knot is secure (not slipping, no air knots).	