Imperial College Laparoscopic Cholecystectomy Training Curriculum

Description

Training within a proficiency-based virtual reality curriculum may reduce errors during real surgical procedures. The following curriculum is based on Development of a Virtual Reality Training Curriculum for Laparoscopic Cholecystectomy (Darzi et al. British Journal of Surgery 2009; 96: 1086–1093).

The study, by the Department of Biosurgery and Surgical Technology at St. Mary's Campus at Imperial College of London, defined, tested and validated a whole-procedure virtual reality training curriculum for laparoscopic cholecystectomy on the Simbionix LAP Mentor™ using structured scientific methodology. The curriculum clearly defines a predetermined level of proficiency as well as defining the mode of training on the simulator.

The aim of the training curriculum is for an individual to acquire skills and reach a predetermined level of proficiency before progressing to more challenging cases.

Objectives

♦   To practice and acquire competence in basic laparoscopic skills: Camera manipulation 0°; Camera Manipulation 30°; Eye-hand coordination; Clip application; Clipping and grasping; Two-handed maneuvers; Cutting; Electrocautery; Translocation of objects.

♦   To demonstrate proficiency in basic laparoscopic skills by achieving the validated level of skill required in clipping and grasping, and two-handed maneuvers tasks.

♦   To practice procedural laparoscopic cholecystectomy tasks: Clipping and cutting a retracted gallbladder; Clipping and cutting using two hands; Calot's triangle dissection; Gallbladder separation.

♦   To demonstrate proficiency in procedural tasks of laparoscopic cholecystectomy by achieving the validated level of skill required in the Calot's triangle dissection and Gallbladder separation tasks.

♦   To master and reach confidence in a complete cholecystectomy procedure by hands-on practice of a virtual patient case.

♦   To demonstrate the validated level of skill required for the full cholecystectomy procedure while performing a simulated case.

Specialties

General Surgery.

Target Audience

Individuals interested in following a structured curriculum to acquire skills to reach a predetermined level of proficiency, before progressing to more challenging cases enabling the trainee to transfer these skills to the real OR environment.

Assumptions

It is recommended to include a cognitive skills module at the front end of the training program. No previous procedural or technical knowledge is required.

Suggested Time Length

Distributed training schedules, with a maximum of two sessions performed per day, each at least one hour apart, until demonstrating the required level of skill by achieving all benchmark levels in two consecutive sessions.

Authors

This curriculum is based on Development of a virtual reality training curriculum for laparoscopic cholecystectomy (Darzi et al. British Journal of Surgery 2009; 96: 1086–1093).

ACCESS ▶ Surgery®

AccessSurgery References:

A subscription to AccessSurgery is required for full access to this content. Contact your institution to find out if it already has a subscription or to obtain an account. If your institution does not subscribe to AccessSurgery, you can purchase an annual or short-term subscription.

Oddsdóttir M, Pham TH, Hunter JG. Chapter 32. Gallbladder and the Extrahepatic Biliary System. In: Brunicardi FC, Andersen DK, Billiar TR, Dunn DL, Hunter JG, Matthews JB, Pollock RE, eds. *Schwartz's Principles of Surgery.* 9th ed. New York: McGraw-Hill; 2010. http://www.accesssurgery.com/content.aspx?aID=5026661.

Nagle AP, Soper NJ, Hines JR. Chapter 32. Cholecystectomy (Open and Laparoscopic). In: Ashley SW, Zinner MJ, eds. *Maingot's Abdominal Operations.* 11th ed. New York: McGraw-Hill; 2007. http://www.accesssurgery.com/content.aspx?aID=129556.

Zollinger, Jr. RM, Zollinger, Sr. RM. Plate 90. Cholecystectomy, Laparoscopic. In: Zollinger, Jr. RM, Zollinger, Sr. RM, eds. *Zollinger's Atlas of Surgical Operations.* 9th ed. New York: McGraw-Hill; 2011. http://www.accesssurgery.com/content.aspx?aID=6821770.

Zollinger, Jr. RM, Zollinger, Sr. RM. Plate 93. Cholecystectomy, Laparoscopic. In: Zollinger, Jr. RM, Zollinger, Sr. RM, eds. *Zollinger's Atlas of Surgical Operations.* 9th ed. New York: McGraw-Hill; 2011. http://www.accesssurgery.com/content.aspx?aID=6821819.

Zollinger, Jr. RM, Zollinger, Sr. RM. Plate 94. Cholecystectomy, Laparoscopic. In: Zollinger, Jr. RM, Zollinger, Sr. RM, eds. *Zollinger's Atlas of Surgical Operations.* 9th ed. New York: McGraw-Hill; 2011. http://www.accesssurgery.com/content.aspx?aID=6821831.

Zollinger, Jr. RM, Zollinger, Sr. RM. Plate 95. Cholecystectomy, Retrograde Method. In: Zollinger, Jr. RM, Zollinger, Sr. RM, eds. *Zollinger's Atlas of Surgical Operations.* 9th ed. New York: McGraw-Hill; 2011. http://www.accesssurgery.com/content.aspx?aID=6821847.

Introduction to Curriculum – Instructors

Training within a proficiency-based virtual reality curriculum may reduce errors during real surgical procedures. The evaluation metrics developed through a scientific methodology, constitute the basis of this training curriculum and are presented here for your reference.

R. Aggarwal, P. Crochet, A. Dias, A. Misra, P. Ziprin and A. Darzi. Development of a virtual reality training curriculum for laparoscopic cholecystectomy. *British Journal of Surgery 2009*; 96: 1086–1093.

Table 3 Metrics for development of the training curriculum

Task	Metric	Construct valid	Learning curve	Plateau session	Benchmark level
Skills					
Clipping and grasping	Time taken (s)	✓	✓	9th	104
	Total speed (cm/s)	✓	✓	2nd	8·3*
Two-handed manoeuvres	Time taken (s)	✓	✓	6th	89
	Total no. of movements	✓	✓	8th	106
	Total path length (cm)	✓	✓	8th	440
Tasks					
Calot's triangle dissection	Time taken (s)	✓	✓	7th	278
	Total no. of movements	✓	✓	7th	241
	Total cautery time (s)	✓	✓	7th	15
Gallbladder separation	Time taken (s)	✓	✓	4th	312
	Time to extract gallbladder (s)	✓	✓	4th	219*
	Total no. of movements	✓	✓	4th	274
	Total path length (cm)	✓	✓	4th	511
Full procedure	Time taken (s)	✓	✓	2nd	548
	Time to extract gallbladder (s)	✓	✓	2nd	521*
	Total no. of movements	✓	✓	3rd	481
	Total path length (cm)	✓	✓	3rd	1012

*Metrics not included in the curriculum (*Fig. 4*).
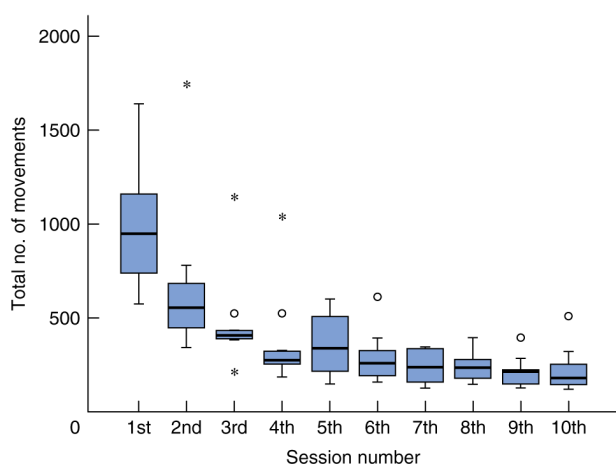

Fig. 3 Learning curve for total number of movements for gallbladder separation. Horizontal lines within boxes, boxes and whiskers represent median, interquartile range and range respectively. Circles and asterisks represent outliers and extreme cases respectively

Task Descriptions and Curriculum Steps

The trainee is required to follow a structured step by step pathway defined in a hierarchical order in the following manner:

1. Introduction to Training

Instructions:
Before each task is performed, provide a full demonstration by an experienced operator, with an opportunity for the subject to ask questions.
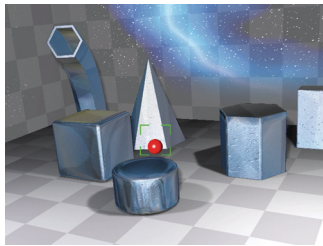Suggested time length for the familiarization period is approximately 30 minutes.
When using the simulator, task tutorials are provided as part of the programmed training.

2. Nine Basic Tasks - Training

Instructions:
Nine tasks are performed twice on the same day in two sessions, with a break of more than one hour between each session.

Task 1 - Camera Manipulation 0°

Task Description:
Using a 0° camera, locate and snap photographs of ten balls, in an abstract environment.
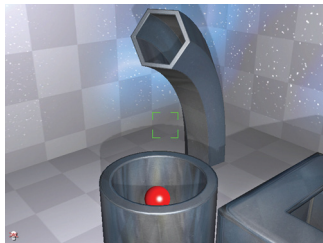
Task 2 - Camera Manipulation 30°

Task Description:
Using a 30° angled camera, locate and snap photographs of ten balls, in an abstract environment.
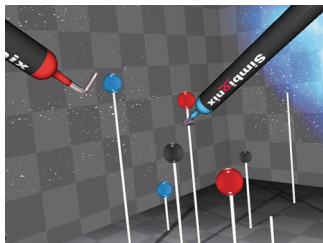
Task 3 - Eye-Hand Coordination
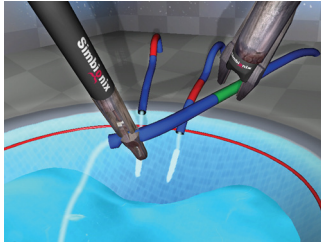
Task Description:
Locate each flashing ball and touch it with the tool of the appropriate color.
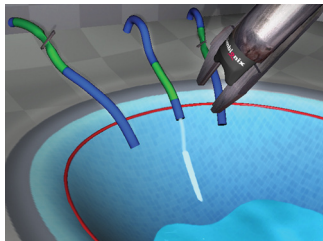
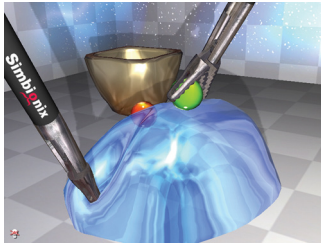
Task 4 - Clip Application

Task Description:
Clip leaking ducts within a specified segment, before the pool fills.

Task 5 - Clipping and Grasping
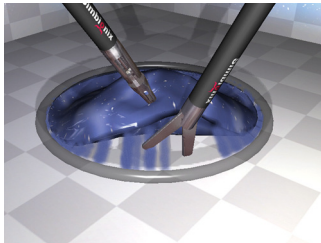
Task Description:
Safely grasp and clip leaking ducts within a specified segment, before the pool fills.

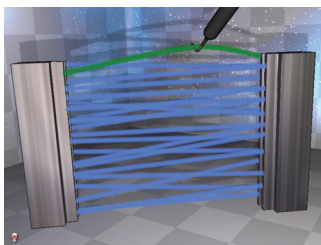## Task 6 - Two-Handed Maneuvers

Task Description:
Use two graspers to locate the balls within the jelly mass and then place them in the endobag.
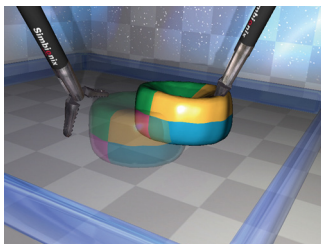
Task 7 - Cutting

Task Description:
Safely cut and separate a circular form using one tool to retract, and the scissors to cut accurately.

Task 8 – Electrocautery

Task Description:
Use a hook to burn the highlighted band, while retracting other bands with an accessory instrument.

Task 9 - Translocation of Objects

Task Description:
Manipulate object with two graspers and, with a minimum number of translocations, place the object into the orientation of the matching transparent object.

3. Two Basic Tasks – Proficiency

Instructions:
Performed for a maximum of two sessions per day, with a break of more than one hour between each session.
Completion of training when all of the following levels of skill are achieved on two consecutive sessions.
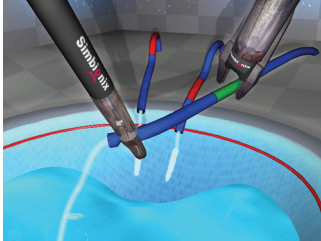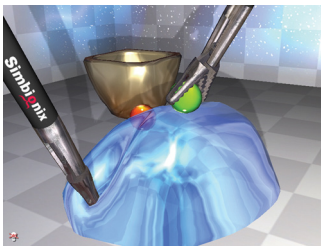

Task 5 - Clipping and Grasping

Task Description:
Safely grasp and clip leaking ducts within a specified segment, before the
pool fills.
Required Skill Level:
Time taken < 100 s

Task 6 - Two-Handed Maneuvers

Task Description:
Use two graspers to locate the balls within the jelly mass and then place them
in the endobag.
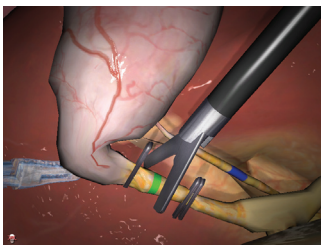**Required Skill Level:**
Total time taken < 90 s
Total number of movements < 100
Total path length < 440 cm

## 4. Procedural Tasks - Training

Instructions:
Performed for a maximum of two sessions per day, with a break of more than one hour between each session.

Task 1 - Clipping and Cutting - Retracted Gallbladder
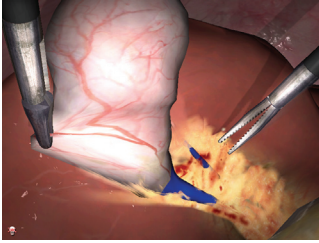
Task Description:
Gallbladder already exposed with Hartmann's pouch retracted by a static
tool. Clip the cystic artery and duct within a specified area and then cut safely
between the clips.
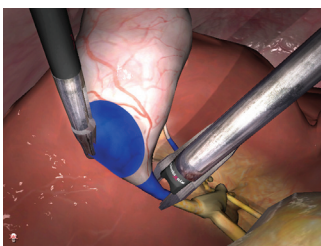
### Task 2 - Clipping and Cutting Using Two Hands

Task Description:
With the gallbladder already exposed use a blunt grasper to retract Hartmann's
pouch. Once correct retraction is achieved, clip the cystic artery and duct within
a specified area and then cut safely between the clips.

Task 3 - Dissection - Achieving the 'Critical View'

Task Description:
Grasp the infundibulum of the gallbladder, retract away from the liver, and dissect the peritoneal coverings to expose the cystic duct and artery.
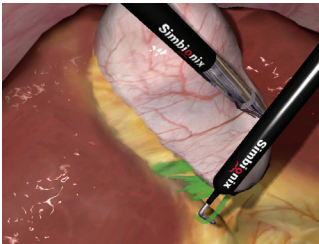
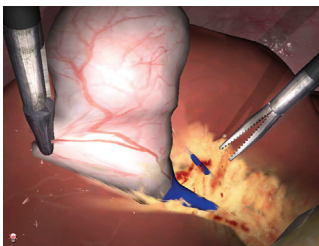### Task 4 - Gallbladder Separation

Task Description:
Separate the gallbladder from the liver bed with appropriate retraction and dissection of the peritoneal adhesions to the liver bed. Continue dissection until the gallbladder is free from the liver.

5. Two Procedural Tasks - Proficiency

Instructions:
Performed for a maximum of two sessions per day, with a break of more than one hour between each session. Completion of training when all of the following levels of skill are achieved on two consecutive sessions.

Task 3 - Dissection - Achieving the 'Critical View'
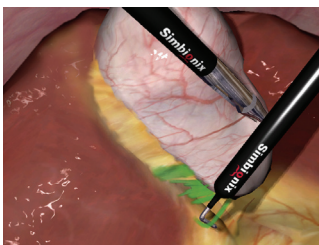
Task Description:
Grasp the infundibulum of the gallbladder, retract away from the liver, and dissect the peritoneal coverings to expose the cystic duct and artery.
Required Skill Level:
Total time taken < 280 s
Total number of movements < 240
Total cautery time < 15 s

Task 4 - Gallbladder Separation

Task Description:
Separate the gallbladder from the liver bed with appropriate retraction and dissection of the peritoneal adhesions to the liver bed. Continue dissection until the gallbladder is free from the liver.
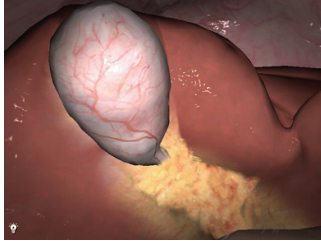**Required Skill Level:**
Total time taken < 300 s
Total number of movements < 275
Total path length < 500 cm

6. Full Procedure Laparoscopic Cholecystectomy - Proficiency

Instructions:
Performed for a maximum of two sessions per day, with a break of more than one hour between each session.
Completion of training when all of the following levels of skill are achieved in two consecutive sessions.

Case 1 - Laparoscopic Cholecystectomy

Task Description:
Virtual complete cholecystectomy procedures, based on anatomies created from CT/MRI real patient data. Practice a complete cholecystectomy procedure with a range of appropriate instruments.

Required Skill Level:
Total time taken < 540 s
Total number of movements < 480
Total path length < 1000 cm