

Laparoscopic Training Center – Basic Course



Description

Junior surgical residents participating in the course use the Simbionix LAP Mentor™ to practice repeatedly in order to develop and demonstrate a required level of basic laparoscopic skills. The goal is to learn the components of the laparoscopic cholecystectomy procedure and to demonstrate the ability to perform it at a high skill level. Advanced simulated surgery exercises are recommended to residents at the end of the basic training program, which allow them to perform more difficult types of surgery, including incisional hernia procedures and basic and advanced suturing tasks.

Experience demonstrates that strictly defined training programs successfully assist the resident in acquiring laparoscopic skills to a significant degree not only in a subjective view, but to a degree that is quantitatively provable. The quality of a course is obtained by means of a preset number of repetitions or by a defined proficiency level. In Switzerland, these preconditions are obligatory for the awarding of CME points. A strict time limit is also necessary. Therefore, course participants are required to complete the course within a time frame of three months. This present course meets these requirements. The course was designed by Dr. sc. techn. Martina Vitz from the Laparoscopic Training Center in Zurich, Switzerland, and is recognized by the Swiss Society for Surgery with 35 CME credits.

Objectives

- ◆ To perfect basic laparoscopic skills by repetition based training. The following skills are practiced: Manipulation of the camera with 0°/30° visual angle (keeping the horizon); Orientation in the laparoscopic environment; Application of the pivot at the simulator; Training of eye-hand coordination; Depth perception in a 2-dimensional picture; Bi-manual handling - manipulation of

laparoscopic instruments; Correct application of a clip applier - principles of safe clipping; Atraumatic grasping and use of coagulation hook; Training of object orientation in space; Introduction to procedural tasks of the laparoscopic cholecystectomy.

- ◆ To experience a hands-on laparoscopic cholecystectomy procedure using the simulator.
- ◆ To gain the necessary knowledge of the cholecystectomy procedure by performing simulated procedures. The following principles are encountered and learnt: Anatomical variants in the gall bladder region; Principles of safe and exact coagulation, controlled severing and correct pulling direction at the infundibulum; Preparation of Calot's triangle; Safe and exact clipping and cutting.
- ◆ To demonstrate the required level of skills to perform a safe and efficient cholecystectomy procedure by repeatedly practicing the simulated procedure. Skills evaluated include: Reaching a good average time to perform the simulated procedure; Accuracy; Safety in cutting and clipping as well as keeping the safety distance between clips; Safe coagulation; Exact and safe preparation of the gall bladder out of the liver bed.



Specialties

General Surgery.

Target Audience

The basic course is of greatest benefit for surgeons in their first to third year of residency. For future surgeons in their fourth to sixth year of residency, advanced courses are more appropriate.

Assumptions

No previous procedural or technical knowledge is required.

Suggested Time Length

Course participants are required to complete the course within a time frame of 3 months.

Authors

This training program was designed by Dr. sc. techn. Martina Vitz of the Laparoscopic Training Center in Zurich, Switzerland.

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AccessSurgery References:

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Hunter JG, Jobe BA. Chapter 14. Minimally Invasive Surgery, Robotics, and Natural Orifice Transluminal Endoscopic Surgery. In: Brunickardi 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=5014248>.

Introduction to Course – Instructors

Introduction to Simulator Training

For several years, simulation has proven to be a suitable method for the education and advanced training of junior surgeons and junior gynecologists, allowing them to acquire and consolidate laparoscopic skills. Numerous studies prove the efficiency of this tool.

In the USA and various countries of the EU, hospitals and institutions for advanced training exist where young residents are trained by means of simulation techniques. Simulators are produced by various firms. For all devices and software versions, however, the same principle holds: Perfection is achieved by practicing. Symbionix simulators provide excellently simulated surgical cases. Residents can first build up the basis of the needed skills in a 'Basic Skills' and 'Procedural Tasks' training environment. In the sector of skill training, there is an extraordinarily detailed suture module, where using the Cuscheri method, residents are gradually guided into laparoscopic suturing.

The LAP Mentor simulation modules provide a great variety of procedures and virtual patients: Cholecystectomy module comprised of 18 anatomical variants, simulated gastric bypass, incisional hernia and sigmoidectomy complete procedure modules. In the field of gynaecology, various simulated ectopic pregnancies, tube sterilization and oophorectomy cases. For the field of laparoscopic urology, a nephrectomy module is provided. The Symbionix simulator is seen by a great number of residents as the Rolls Royce of simulators, as it offers a wide range of training possibilities. Surgical residents are driven to success, especially if they have not yet performed an operation or a certain procedure themselves.

Success-Oriented Simulation Training

The approach adopted by the Laparoscopic Training Center in Zurich is to train course participants until there are no further significant improvements. This approach is based on analysis of residents' learning curves after repetition based practice. From this method, a course was developed with simulator training designed to promote normally gifted residents to a maturity level for performing in the operation theatre.

Long-standing experience shows that successful simulation training presupposes a motivated instructor team, motivated trainers and motivated residents.

Instructor Team - Checklist

- ◆ The instructor should have used the simulator himself/herself already, should be positively convinced of the simulation technology benefits, and be able to motivate his/her team to train. He/she is the first contact person for residents needing help.
- ◆ Should be capable of solving logistic and technical problems and is responsible for the simulator and should have the time to do so.
- ◆ Should be a person who knows and has mastered the various modules of the simulator.
- ◆ Should be able to guide residents to optimally perform the exercises.
- ◆ Able to adjust the design of the training individually to suit the abilities of the resident.
- ◆ Should be available for at least one hour per resident, to help avoid startup difficulties.
- ◆ Complete knowledge regarding gallbladder surgery.
- ◆ Regularly checks whether everything is going well with the residents.

Data Analysis and Evaluation

After completion of the training, the data is analyzed and evaluated by an expert on the basis of experience-based values. The evaluation is presented to the participant and discussed.

The course is only valid after the surgical resident reaches a certain proficiency level for the basic skills and procedural tasks and repeats the gallbladder cases a minimum of 10 times per exercise.

Basic Skills and Procedural Tasks

In general, the following aspects are taken into account:

- ◆ The exercise is performed with 100% accuracy rate.
- ◆ The exercise is safely performed: Safe retraction; Safe cautery; Efficiency of cautery; Safety distances.
- ◆ The exercise has to be done within the time limits.

Basic Skills Required Skill Level Experience Based Assessment						
	BS Task 1 Camera Manipulation	BS Task 3 Eye-Hand Coordination	BS Task 5 Clipping and Grasping	BS Task 7 Cutting	BS Task 8 Electrocautery	BS Task 9 Translocation of Objects
Accuracy Rate	Accuracy rate = 100%	Accuracy rate = 100%	Accuracy rate - applied clips = 100%	Accuracy rate = 100%	Accuracy rate - highlighted bands = 100%	-
Time	Total time = 120 s	Total time = 100 s	Total time = 150 s	Total time = 200 s	Total time = 300 s	Total time = 500 s
Other	Horizontal view = 80%	-	-	Safe retraction = 100%	Efficiency of cautery 80%	Efficiency of translocations 75%
Economy of Movements	Total path length left/right ≤ 200 cm	Economy of Movements ≥ 60%	Economy of Movements ≥ 60%	-	-	Total path length left/right 1000 cm
Average Speed of Instrument	<10 cm/s	<2cm/s	<2cm/s	<2cm/s	<2cm/s	<2cm/s

Lap Chole Procedural Tasks Required Skill Level - Experience Based Assessment		
	Task 2 - Clipping and Cutting Using Two Hands	Task 3 - Dissection – Achieving the ‘Critical View’
Accuracy Rate	Accuracy rate – clipping and cutting on the marked lines = 100%	Completed dissection = 50%
Time	Total Time = 120 s	Total Time = 300 s
Safety	Safety distance cut-clip = >3 mm	Safe cautery = > 90%
Complications	Number of serious complications: possible damage to vital structures = 0	Number of serious complications: possible damage to vital structures = 0
Economy of Movements	Path length of right instrument = 100 cm Path length of left instrument = 75 cm	Path length of right instrument = 400 cm Path length of left instrument = 100 cm

Cholecystectomy Procedures

A learning curve will be produced based on to the 60 repetitions of the gallbladder operations.

This curve is produced individually for each case and for the total data set.

To allow an easier interpretation of the curve diagram, an exponential function was fitted over the respective data points. If desired, an arbitrary expert level can be displayed over the participants' results for comparison reasons. This function is generally used for courses of learning curves.

Cholecystectomy Procedures Required Skill Level - Experience Based Assessment		
	Preliminary Goal After 10-15 Repetitions	Goal After 60 Repetitions
Anatomy	Quick recognition of the new anatomy	Immediate recognition of the new anatomy
Average Time	Very good average time (about 400 sec)	Very good average time (about 300 sec)
Movement Parameters	Movement parameters match very well with time parameter (600 cm / 150 cm)	Movement parameters match very well with time parameter (450 cm / 120 cm)
Curve	Curve declining	Curve slightly declining (Plateau reached after approximately 50 simulations)
Complications	Acceptable number of "serious complications" (a total of 3/10)	Few "serious complications" (maximum of 15/60)

Evaluation and Feedback

Day courses provide an impression of the skills required for laparoscopic surgery. Only repeated training over a longer period of time will produce a real training effect. This is the unique advantage of the simulator training course - the exact evaluation of the exercises performed provides and demonstrates a training result.

The participant will receive a table listing the tested skills and his/her respective performance.

An extract of an evaluation and feedback file is given in *Box 1*. In the given case, the participant reached an acceptable level in both of the training modules ('Basic skills' and 'Procedural tasks'), and an excellent level in the subsequent 'Full procedures'. Time requirements for the overall completion of the course were met very well.

Discussion of the Results

If desired, the instructor can discuss the outcome personally with the resident after completion of the curriculum.

Dear Participant,

The following table gives an overview over your performance during the training.

Part 1 - Basic Skills and Procedural Tasks Performance:

Evaluation of the overall performance in regards to expert levels.

Task	Assessment
Basic Skill 1	Excellent
Basic Skill 2	Excellent
Basic Skill 3	Excellent
Basic Skill 4	Good
Basic Skill 5	Attended Successfully
Basic Skill 6	Economy of Movements should be a bit higher.
Basic Skill 7	Good
Basic Skill 8	Attended Successfully
Basic Skill 9	Path lengths of the instrument are too long. Refrain from unnecessary movements.

Task	Assessment
Procedural Task 1	Try to be more precise.
Procedural Task 2	Good
Procedural Task 3	Try not to use coagulation without tissue contact.
Procedural Task 4	Attended Successfully

How to read this file:

- ◆ Excellent – Your values are better than the preset required skill level.
- ◆ Good – Your values are according to the preset required skill level.
- ◆ Attended Successfully – Your values fall below the preset required skill level by 15% at most.
- ◆ Other remarks according to the necessity.

Part 2 - Learning Curves in the Operative Techniques of Simulated Cholecystectomy:

Learning curves with instructor input for performance improvement.

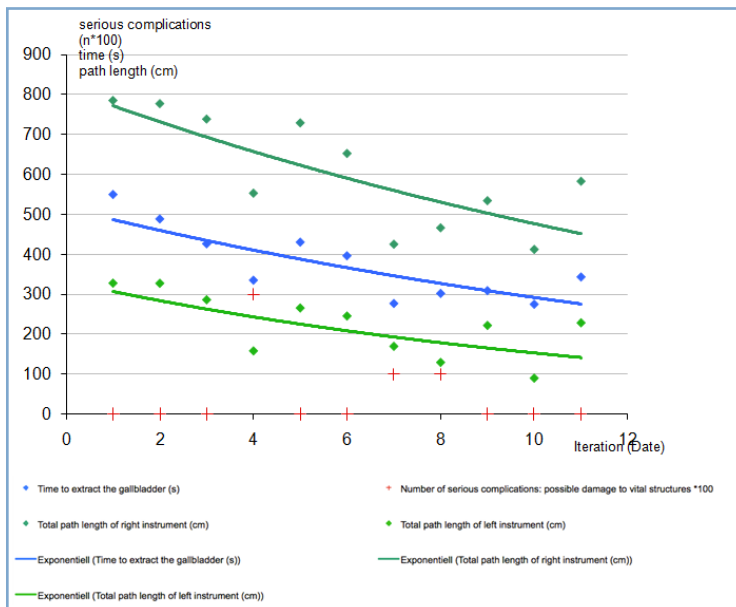


Figure 1. Sorted According to Case - An Example - Case 1

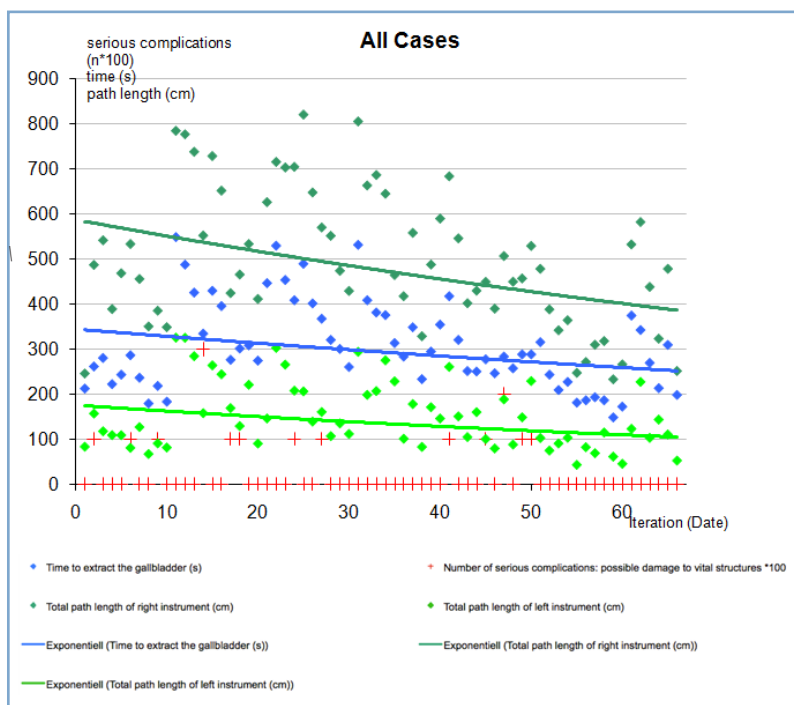


Figure 2. Across All Cases - An Example

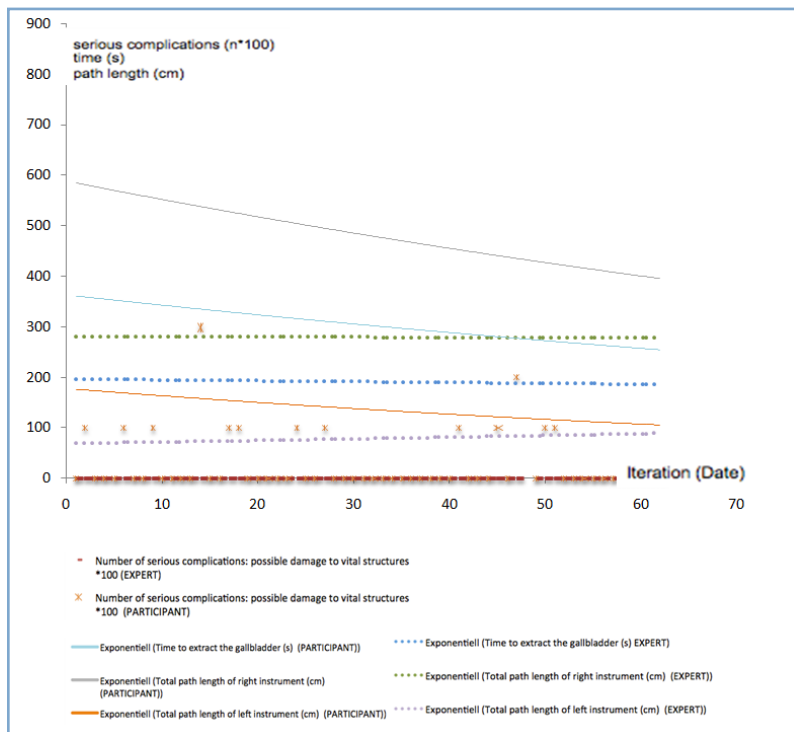


Figure 3. Across All Cases – Comparison with Expert Data

Box 1- Evaluation for the Participant

Task Descriptions and Training Curriculum Steps

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

1. Introduction to Training

Instructions:

The participants should receive a complete course description and some supplementary information. Participants will become familiar with the simulator by one-on-one instructions given by a specially trained instructor. Participants will receive precise information about the various training programs they will have to complete and the goals they will have to reach.

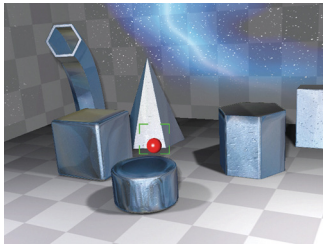
For the evaluation of exercises and full procedures, 15 repetitions of each basic task and each procedural task, as well as 10 repetitions of each full procedure case must be completed.

2. Basic Skills and Procedural Tasks - Independent Training

Participants will have access to the simulator, enabling them to train independently at will. During these training sessions, an instructor will be available to answer questions, if requested. Simulator tasks results will be examined by the instructor.

Instructions:

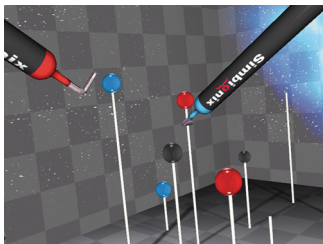
- ◆ 10-15 hours for each candidate without instructor.
- ◆ 15 repetitions of each task.



Basic Skills Task 1 - Camera Manipulation 0°

Task Description:

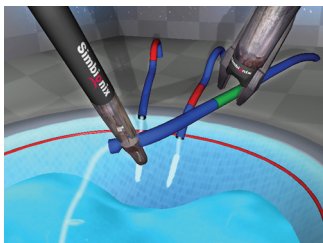
Using a 0° camera, locate and snap photographs of ten balls, in an abstract environment.



Basic Skills Task 3 - Eye-Hand Coordination

Task Description:

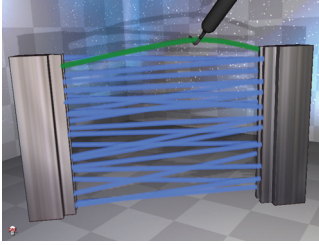
Locate each flashing ball and touch it with the tool of the appropriate color.



Basic Skills Task 5 - Clipping and Grasping

Task Description:

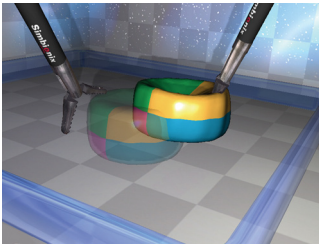
Safely grasp and clip leaking ducts within a specified segment, before the pool fills.



Basic Skills Task 8 – Electrocautery

Task Description:

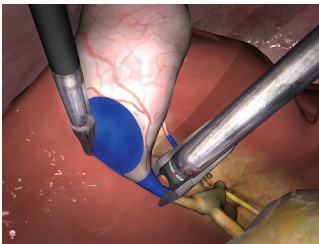
Use a hook to burn the highlighted band, while retracting other bands with an accessory instrument.



Basic Skills Task 9 - Translocation of Objects

Task Description:

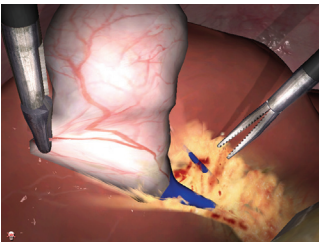
Manipulate object with two graspers and, with a minimum number of translocations, place the object into the orientation of the matching transparent object.



Procedural 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.



Procedural 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.

3. 60 Full-Procedure “Cholecystectomies” - Independent Training

After reaching the required skill level for the basic and procedural tasks, the resident may continue training and practice full procedures.

At this stage, the instructor presents a gall bladder to the participant at the simulator.

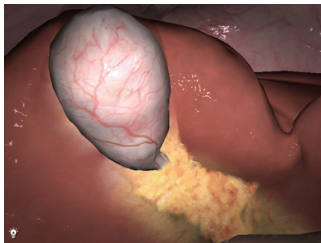
A great variety of different anatomies are available for the participants to train in cholecystectomy. There are six basic anatomies, each with various sub-anatomies. Participants perform each respective surgery 10 times. At the end of the training, a learning curve is produced and discussed. For potential problems and questions, an instructor will be available.

Instructions:

- ◆ Perform 10 repetitions of each simulated case per training day.
- ◆ Perform cases in sequence. For example, perform Case #1 10 times in succession before continuing to the next case.
- ◆ 10-15 hours for each candidate without instructor.
- ◆ Results will be examined by the instructor.

Required Skill Level:

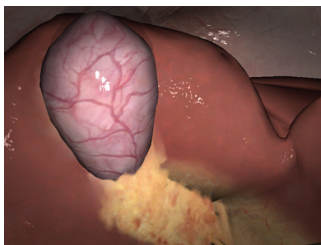
- ◆ Immediate recognition of the new anatomy
- ◆ Good average time (about 400 sec)
- ◆ Movement parameters match with time parameter very well (600 cm / 150 cm)
- ◆ Declining learning curve
- ◆ Acceptable number of “serious complications” (a total of 3/10)



Case 1 – Laparoscopic Cholecystectomy

Task Description:

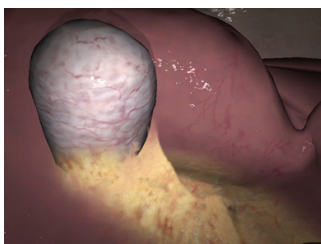
Practice a complete cholecystectomy procedure.
Three anatomical variations.



Case 2 – Laparoscopic Cholecystectomy

Task Description:

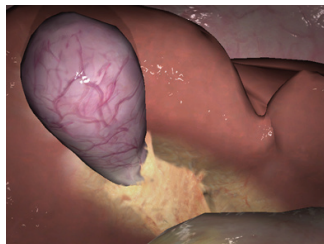
Practice a complete cholecystectomy procedure.
Three anatomical variations.



Case 3 – Laparoscopic Cholecystectomy

Task Description:

Practice a complete cholecystectomy procedure.
Three anatomical variations.



Case 4 – Laparoscopic Cholecystectomy

Task Description:

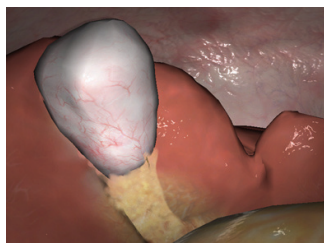
Practice a complete cholecystectomy procedure.
Three anatomical variations.



Case 5 – Laparoscopic Cholecystectomy

Task Description:

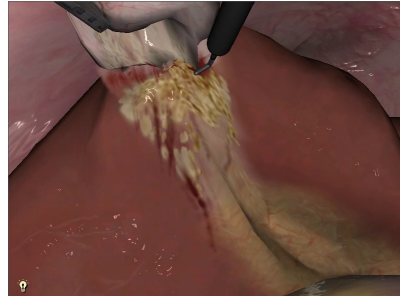
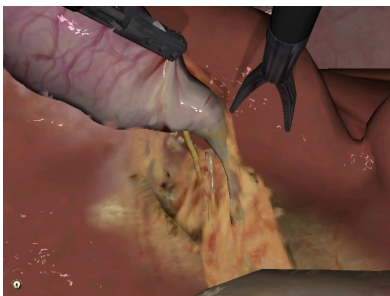
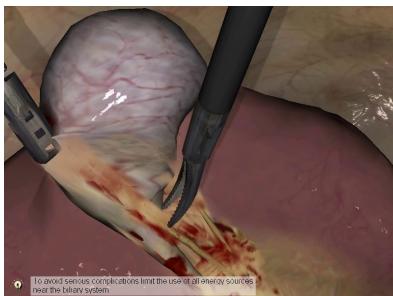
Practice a complete cholecystectomy procedure.
Three anatomical variations.



Case 6 – Laparoscopic Cholecystectomy

Task Description:

Practice a complete cholecystectomy procedure.
Three anatomical variations.



References

1. Dr. sc. techn. Martina Vitz. The Laparoscopic Training Center in Zurich, Switzerland.
<http://www.lapcenter.ch>
2. Yamaguchi, S., Konishi, K., Yasunaga, T., Yoshida, D., Kinjo, N., Kobayashi, K., Ieiri, S., Okazaki, K., Nakashima, H., Tanoue, K., Maehara, Y., Hashizume, M. *Construct validity for eye-hand coordination skill on a virtual reality laparoscopic surgical simulator.* Department of Disaster and Emergency Medicine, Graduate School of Medical Sciences, Kyushu University, Fukuoka, Japan Surg Endosc. May 4, 2007.
3. Greco, E. M.D., Escallon, J. M.D., Grantcharov, T. M.D., Okrainec, A. M.D. *Do Performance Measures on the LapMentor VR Simulator Predict FLS Performance?* University Health Network, Department of Surgery, University of Toronto, Canada. The abstract was presented at the Canadian Association of General Surgeons Annual Meeting on September 11-14, 2008 Halifax, Nova Scotia, Canada.
4. Allan Okrainec, MD, Ara Tekian, MHPE, PhD, Mary-Anne Aarts, MD, Teodor Grantcharov, MD, PhD, Jaime Escallon, MD, and Richard Reznick, MD, Med. *Virtual reality training on basic laparoscopic tasks vs. virtual reality training of an entire surgical procedure: A randomized controlled trial using real world operations as an outcome.* Department of Surgery, University of Toronto, Toronto, Ontario. Department of Medical Education, University of Illinois at Chicago. The abstract was presented at the Annual Meeting of the Association of Surgical Educators (ASE) April 28-30, 2009, Salt Lake City, Utah.

