Chapter 59
Robotic Bariatric Surgeon Training

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59.1 Introduction

Surgery, like other specialties, has been profoundly modified by technological advances. In 1999, Intuitive Surgical Inc. (Sunnyvale, CA, USA) introduced the *da Vinci* surgical system, which has been adopted worldwide. The number of robotic bariatric surgeries is increasing rapidly—in the United States, more than 7% of bariatric procedures are performed using a robotic approach. Operative time remains significantly longer in robotics compared to laparoscopic ones, but there is a trend toward improvement in key quality and patient outcome metrics as usage increases [1].

The rapid advancement of robotic surgery led to the need of a standardized method of training surgeons in robotic surgery. Acquiring these skills in a simulation lab, rather than in the operating room, has significant advantages for surgeons in training, hospitals, and patients [2–4].

59.2 Simulation Training

The acquisition of surgical skills through simulation plays a central role in the curricula of medical education institutions. Robotic surgery is a perfect model for simulation-based training: easy setup, performance tracking, distance learning, standardized methods, and lower costs.

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A. Teixeira et al. (eds.), *Duodenal Switch and Its Derivatives in Bariatric and Metabolic Surgery*, https://doi.org/10.1007/978-3-031-25828-2_59

Training to perform robotic surgery involves a simulator with stations for handling objects, movement control, energy use, sutures, and other skills. Some of the available models are the dV-trainer and Flex VR from Mimic Technologies (Seattle, WA, USA), RobotiX from Simbionix (Israel), and Skills Simulator da Vinci®-dVSS from Intuitive Surgical (Sunnyvale, CA, USA). They are complete standalone simulation solutions mimicking the da Vinci system hardware. The Fundamental Robotic Surgery Skills (FRSS) curriculum has proven its effectiveness in acquiring basic robotic skills and has been widely adopted [2, 4].

Robotic simulators present validation of competences as an educational tool and an assessment device. They provide excellent interface, content, construction, and validity evidence, delivering a comprehensive robotic surgery training tool [5–7]. The surgeon receives a performance assessment immediately after the exercise, providing guidance on what needs to be improved, or if it was performed correctly. The surgeon can, in this way, familiarize himself with the equipment and, after exhaustive training, perform the initial procedures with more skill and precision, decreasing the learning curve (as already shown in controlled studies) and possibly the risks of accidents and complications [8].

The DVSS and dV-Trainer share the same scoring method. MScore® is the software used, grouping exercise metrics into categories to measure proficiency level [9, 10]. After performing the exercises, the simulator provides scores based on the user's performance, which will be linked to various aspects involved in the execution, such as the activity execution time, economy of movement, arms collision, and maximum use of the workspace, among others, more specific to each proposed exercise, such as the use of energy unnecessarily in dissection exercises [1] (Table 59.1).

Table 59.1 Examples of metrics used in the skills simulator

Metric	Definition
Motion economy	Distance travelled by instruments
Master workspace range	Size of the area controlled by the surgeon's hand
Time to complete	Time to complete the task
Blood loss volume	Amount of blood lost
Dropped needles	Number of times object is dropped
Excess needle passages	Number of extra needle "bites" taken
Excessive force	When the force on an instrument is too large (shown when the instrument turns red)
Incorrect targets	Number of times target was missed
Instrument collisions	Number of times instruments collided (with another instrument or with the endoscope)
Instruments out of view	When instruments are taken outside of the visible field
Needle out of view	When needle is taken outside of the visible field
Scope collisions	When instruments collide with the target
Suture breaks	When the suture is broken due to excessive force

Simulators allow administrators to track learning performance and progress over time, customize user accounts, create and share custom simulation curricula, manage courses, and export data for in-depth analysis. In addition, the score history can show the most important areas for improvement [9].

59.3 Learning Curve and Training Curricula in Bariatric Robotic Surgery

Despite the increased dexterity and accuracy of robotic surgery, like any new surgical technology, it is still associated with a learning curve that may lead to negative patient outcomes. The use of surgical simulators is a low-risk environment, which has been shown to shorten these learning curves [3, 11].

There are no protocols for specific training of robotic bariatric surgeons that are different from other specialties. There is already a tendency for specialties to have their own benchmark score in the simulator to determine competences, thus creating minimum benchmarks for each proposed activity in the robotic virtual reality environment. These benchmark scores are obtained through the performance of specialists in robotic surgery. Thus, the reference scores derived from specialists in that type of procedure provide minimum scores for surgeons in training and allow the training to be based on a competency curriculum [5, 12].

After qualifying in the simulators, the surgeon in training must start practicing real surgeries under the mentoring of an experienced robotic surgeon. There is no consensus on the number of surgeries that should be performed under supervision. In laparoscopic surgery, IFSO recommends that the professional has a minimum experience of 100 weight loss surgeries to obtain credentials to perform bariatric procedures. IFSO considers bariatric surgery to be an advanced laparoscopic procedure that requires comparable skills, such as laparoscopic hiatal hernia repair, laparoscopic gastrointestinal resection, and laparoscopic splenectomy. It is advised that the surgeon has experience in non-bariatric procedures before starting laparoscopic bariatric operations [13].

59.4 Stages of Training in the da Vinci® System

Intuitive has developed a training protocol specially designed to develop the skills needed by the surgeon in a complete and consolidated way. The surgeon first needs to become familiar with the system through simulators, videos, and live case observations and progressively advances the skills. After this phase, surgical practices should be planned according to their specialty, with an experienced proctor in that specialty [9, 14].

1. Online training through the da Vinci community—videos explaining technical aspects of the device
2. Practical training—practical lessons on a simulator and the actual robotic platform, with a company representative

3. Online certification—online test evaluating completion of steps 1 and 2
4. Laboratory certification—a practical test performed by an intuitive specialized evaluator, assessing simulator practice and in vivo procedures
5. Post-certification—surgical procedures done under the supervision of a proctor (highly specialized surgeon)

References

1. Scarritt T, et al. Trends in utilization and perioperative outcomes in robotic-assisted bariatric surgery using the MBSAQIP database: a 4-year analysis. Obes Surg. 2021;31(2):854–61.
2. Moglia A, et al. A systematic review of virtual reality simulators for robot-assisted surgery. Eur Urol. 2016;69(6):1065–80.
3. Schlottmann F, Patti MG. Novel simulator for robotic surgery. J Robot Surg. 2017;11(4):463–5.
4. Stegemann AP, et al. Fundamental skills of robotic surgery: a multi-institutional randomized controlled trial for validation of a simulation-based curriculum. Urology. 2013;81(4):767–74.
5. Culligan P, et al. Predictive validity of a training protocol using a robotic surgery simulator. Urogynecology. 2014;20(1):48–51. http://www.fpmrs.net/
6. Finnerty BM, et al. General surgery training and robotics: are residents improving their skills? Surg Endosc. 2016;30(2):567–73.
7. Wiener S, et al. Construction of a urologic robotic surgery training curriculum: how many simulator sessions are required for residents to achieve proficiency? J Endourol. 2015;29(11):1289–93.
8. Di Angelantonio E, et al. Body-mass index and all-cause mortality: individual-participant-data meta-analysis of 239 prospective studies in four continents. Lancet. 2016;388(10046):776–86.
9. Intuitive Surgical. Manual do utilizador do skills simulator da Vinci Xi. Sunnyvale: Intuitive Surgical; 2018.
10. Mimic Technologies Inc. dV-Trainer robotic simulator users manual. Seattle: Mimic Technologies Inc.; 2012.
11. Kumar A, Smith R, Patel VR. Current status of robotic simulators in acquisition of robotic surgical skills. Curr Opin Urol. 2015;25(2):168–74.
12. Raison N, et al. Competency based training in robotic surgery: benchmark scores for virtual reality robotic simulation. BJU Int. 2017;119(5):804–11.
13. De Luca M, Himpens J, Weiner R. IFSO statement: credentials for bariatric surgeons 2015. Obes Surg. 2015;25(3):394–6.
14. Intuitive Surgical. Da Vinci education. Sunnyvale: Intuitive Surgical; 2021.