The SAGES University Masters Program Series
Editor-in-Chief: Brian P. Jacob

The SAGES Manual of Robotic Surgery

Ankit D. Patel
Dmitry Oleynikov
Editors

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Foreword

Several years ago I was asked to write a commentary on robotic surgery for a well-regarded surgical publication. At that time I was not a big fan of this new tool. I was impressed with the technological platform of robotic surgical systems and at that time I felt (as I still do today) that the platform held tremendous potential in the future. However, outcomes at that time were equivalent to standard laparoscopic surgery yet the one-time cost of the robot coupled with the ongoing costs of the service contract and the instruments used in each case were, in my view, exorbitant. I felt that given the relative lack of gold-standard evidence confirming that robotic surgery was associated with better patient outcomes when compared to current laparoscopic techniques and the cost which was associated with robotic surgical systems placed the new innovation in jeopardy. In short, I felt it was a little like using a Cadillac for a golf cart.

Spring forward several years; I must admit that I have developed a significantly different point of view. The robot does provide significant advantages in terms of ergonomics and enhanced minimally invasive surgical abilities for surgeons. In addition, it is a platform that can be further developed to facilitate smaller and smaller incisions. However, I still believe that it's important to point out that the robot is simply a tool—an expensive tool at that. In order to fully maximize the value of care provided to patients using this tool, surgeons must be efficient with setting up the device, have a clear understanding of the steps of an operation for which they are using the robot, minimize unnecessary use of expensive instruments during the conduct of an operation, and have equivalent outcomes to those reported for similar operations performed using laparoscopic or open techniques.

This manual provides a wealth of practical material regarding the application of robotics to common and complex minimally invasive surgery scenarios. Surgeons that actually do these operations using this tool wrote the chapters in this manual. The chapters give advice about room setup, patient positioning, proper robot positioning, as well as step-by-step descriptions of how each surgical procedure should

be conducted. I am most impressed with the material compiled in this manual and I am convinced that the concepts outlined, if followed by the reader, will add to the value of care that we provide to our patients. Enjoy.

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Preface

The number of robotic surgery procedures has significantly increased in the last few years, especially in general surgery and its subspecialties. Several advantages of the platform, such as three-dimensional visualization, articulating instruments, and improved ergonomics, have led to its adoption in minimally invasive procedures. As the techniques have evolved and been refined, it has allowed more surgeons access to a minimally invasive approach that they would have otherwise performed in a traditional open fashion, allowing potential benefits to the patient including less pain, less blood loss, and less wound-related complications. While laparoscopy continues to be the standard of care for cholecystectomy, robotics may be enabling in more complex gastrointestinal and hernia procedures.

This textbook is designed to present a comprehensive approach to the various applications of surgical techniques and procedures currently performed using a robotic surgical platform. The initial chapters address preliminary issues faced by surgeons and staff who may be initially undertaking these new techniques. These areas include training and credentialing, as well as instrumentation and platforms commonly used for these procedures. Subsequent chapters focus on specific disease processes and the robotic applications for those procedures, divided among the specialties. Written by unbiased experts in that field, each of these sections address issues such as patient selection, preoperative considerations, positioning and technical aspects of these operations, and how to avoid complications. Many have included their own experience and handy tips for a successful procedure.

The goal of the text is to embrace the robotic technology in its current form and what it holds in the future. Continuous technologic improvements will make the platform more versatile and improve access for surgeons and for patients. Inevitably other robotic and computer-aided technologies will follow in the future and may one day profoundly change how we perform surgery. We are grateful to these SAGES members for sharing their knowledge and we hope you will be able to utilize this in your new or current practice. We would also like to acknowledge Intuitive Surgical for allowing us to use their diagrams and pictures without any restrictions.

Atlanta, GA, USA — Ankit D. Patel
Omaha, NE, USA — Dmitry Oleynikov

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Part I

Masters

Overview of SAGES MASTERS Program

1

Daniel B. Jones, Brian P. Jacob, and Linda Schultz

The SAGES MASTERS Program organizes educational materials along clinical pathways into discrete blocks of content which could be accessed by a surgeon attending the SAGES annual meeting or by logging into the online SAGES University (Fig. 1.1) [1]. The SAGES MASTERS program currently has eight pathways including: Acute Care, Biliary, Bariatrics, Colon, Foregut, Hernia, Flexible Endoscopy, and Robotic Surgery (Fig. 1.2). Each pathway is divided into three levels of targeted performance: Competency, Proficiency, and Mastery (Fig. 1.3). The levels originate from the Dreyfus model of skill acquisition [2], which has five stages: novice, advanced beginner, competency, proficiency, and expertise. The SAGES MASTERS Program is based on the three more advanced stages of skill acquisition: competency, proficiency, and expertise. *Competency* is defined as what a graduating general surgery chief resident or MIS fellow should be able to achieve; *Proficiency* is what a surgeon approximately 3 years out from training should be able to accomplish; and *Mastery* is what more experienced surgeons should be able to accomplish after seven

Adopted from Jones DB, Stefanidis D, Korndorffer JR, Dimick JB, Jacob BP, Schultz L, Scott DJ, SAGES University Masters Program: a structured curriculum for deliberate, lifelong learning. Surg Endoscopy, 2017, in press.

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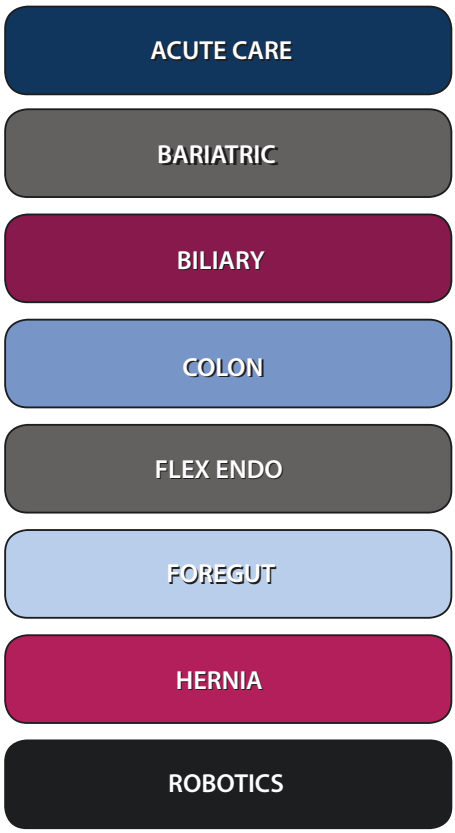
Fig. 1.1 MASTERS Program logo

Fig. 1.2 MASTER Program clinical pathways



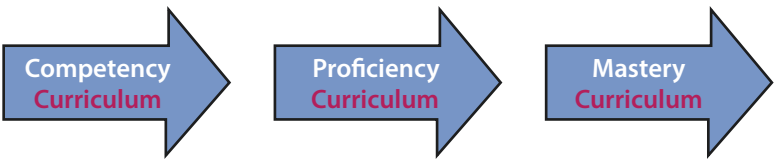


Fig. 1.3 MASTERS Program progression

or more years in practice. Mastery is applicable to SAGES surgeons seeking in-depth knowledge in a pathway, including the following: Areas of controversy, outcomes, best practice, and ability to mentor colleagues. Over time, with the utilization of coaching and participation in SAGES courses, this level should be obtainable by the majority of SAGES members. This edition of the SAGES Manual—Robotic Surgery aligns with the current version of the new SAGES University MASTERS Program Robotic Surgery pathway (Table 1.1).

Table 1.1 Robotic curriculum

Curriculum elements	**Competency**
Anchoring procedure—Competency	2
CORE LECTURE	1
CORE MCE 70%	1
Annual meeting content	8
Guidelines	1
SA CME hours	6
Sentinel articles	2
Social media	2
Hands-on robotic proficiency verification	12
Credits	*35*
Curriculum elements	**Proficiency**
Anchoring procedure—Proficiency	2
CORE LECTURE	1
CORE MCE 70%	1
Annual meeting content	5
FUSE	12
Outcomes database enrollment	2
SA CME hours (ASMBS electives, SAGES or SAGES-endorsed)	3
Sentinel articles	2
Social media	2
Credits	*30*
Curriculum elements	**Mastery**
Anchoring procedure—Mastery	2
CORE LECTURE	1
CORE MCE 70%	1
Annual meeting content	3
Fundamentals of surgical coaching	4
Outcomes database reporting	2
SA CME credits (ASMBS electives, SAGES or SAGES-endorsed)	5
Sentinel articles	2
Serving as video assessment reviewer and providing feedback (FSC)	4
Social media	6
Credits	*30*

Robotic Surgery Curriculum

The Robotic Curriculum is a little different from the other SAGES MASTERS Program pathways. To complete the robotic pathway, a robotic surgeon should complete requirements in the corresponding pathway. For example, for successful completion of the Robotic Competency Curriculum for Hernia, the learner should be able to demonstrate a robotic ventral hernia for competency, a robotic inguinal hernia for proficiency, and a robotic complex abdominal wall reconstruction or a recurrent hernia repair to accomplish mastery. This recognizes the importance of understanding disease and also unique technical expertise of mastering the robot technology.

The key elements of the Robotic Surgery curriculum include core lectures for the pathway, which provides a 45-min general overview including basic anatomy, physiology, diagnostic workup, and surgical management. As of 2018, all lecture content of the annual SAGES meetings are labeled as follows: Basic (100), intermediate (200), and advanced (300). This allows attendees to choose lectures that best fit their educational needs. Coding the content additionally facilitates online retrieval of specific educational material, with varying degrees of surgical complexity, ranging from introductory to revisional surgery.

SAGES identified the need to develop targeted, complex content for its mastery level curriculum. The idea was that these 25-min lectures would be focused on specific topics. It assumes that the attendee already has a good understanding of diseases and management from attending/watching competency and proficiency level lectures. Ideally, in order to supplement a chosen topic, the mastery lectures would also identify key prerequisite articles from *Surgical Endoscopy* and other journals, in addition to SAGES University videos. Many of these lectures will be forthcoming at future SAGES annual meetings.

The MASTERS Program has a self-assessment, multiple-choice exam for each module to guide learner progression throughout the curriculum. Questions are submitted by core lecture speakers and SAGES annual meeting faculty. The goal of the questions is to use assessment for learning, with the assessment being criterion referenced with the percent correct set at 80%. Learners will be able to review incorrect answers, review educational content, and retake the examination until a passing score is obtained.

The MASTERS Program Robotic Surgery curriculum taps much of the of SAGES existing educational products including FLS, FES, FUSE, SMART, Top 21 videos and Pearls (Fig. 1.4). The Curriculum Task Force has placed the aforementioned modules along a continuum of the curriculum pathway. For example, FLS, in general, occurs during the Competency Curriculum, whereas the Fundamental Use of Surgical Energy (FUSE) is usually required during the Proficiency Curriculum. The Fundamentals of Laparoscopic Surgery (FLS) is a multiple-choice exam and a skills assessment conducted on a video box trainer. Tasks include peg transfer, cutting, intracorporeal and extracorporeal suturing, and knot tying. Since 2010, FLS has been required of all US general surgery residents seeking to sit for the American Board of Surgery qualifying examinations. The Fundamentals of Endoscopic Surgery (FES)

Fig. 1.4 SAGES educational content: FLS, FUSE, FES, SMART, Top 21 video

assesses endoscopic knowledge and technical skills in a simulator. FUSE teaches about the safe use of energy devices in the operating room and is available at FUSE.didactic.org. After learners complete the self-paced modules, they may take the certifying examination.

The SAGES Surgical Multimodal Accelerated Recovery Trajectory (SMART) Initiative combines minimally invasive surgical techniques with enhanced recovery pathways (ERPs) for perioperative care, with the goal of improving outcomes and

patient satisfaction. Educational materials include a website with best practices, sample pathways, patient literature, and other resources such as videos, FAQs, and an implementation timeline. The materials assist surgeons and their surgical team with implementation of an ERP.

Top 21 videos are edited videos of the most commonly performed MIS operations and basic endoscopy. Cases are straightforward with quality video and clear anatomy.

Pearls are step-by-step video clips of 10 operations. The authors show different variations for each step. The learner should have a fundamental understanding of the operation.

SAGES Guidelines provide evidence-based recommendations for surgeons and are developed by the SAGES Guidelines Committee following the Health and Medicine Division of the National Academies of Sciences, Engineering, and Medicine standards (formerly the Institute of Medicine) for guideline development [3]. Each clinical practice guideline has been systematically researched, reviewed, and revised by the SAGES Guidelines Committee and an appropriate multidisciplinary team. The strength of the provided recommendations is determined based on the quality of the available literature using the GRADE methodology [4]. SAGES Guidelines cover a wide range of topics relevant to the practice of SAGES surgeon members and are updated on a regular basis. Since the developed guidelines provide an appraisal of the available literature, their inclusion in the MASTERS Program was deemed necessary by the group.

The Curriculum Task Force identified the need to select required readings for the MASTERS Program based on key articles for the various curriculum procedures. Summaries of each of these articles follow the American College of Surgeons (ACS) Selected Readings format.

Facebook™ Groups

While there are many great platforms available to permit online collaboration by user-generated content, Facebook (™) offers a unique, highly developed mobile platform that is ideal for global professional collaboration and daily continuing surgical education (Fig. 1.5). The Facebook groups allow for video assessment, feedback, and coaching as a tool to improve practice, and their use to enhance professional surgical education has been validated by Dr. Brian Jacob's International Hernia Collaboration closed Facebook group.

Based on the anchoring procedures determined via group consensus (Table 1.2) participants in the MASTERS Program will submit video clips on designated SAGES closed Facebook groups, with other participants and/or SAGES members providing qualitative feedback. Using crowdsourcing, other surgeons would comment and provide feedback.

Eight, unique vetted membership-only closed Facebook groups were created for the MASTERS Program, including a group for bariatrics, hernia, colorectal, biliary, acute care, flexible endoscopy, robotics, and foregut. The SAGES Robotic Surgery group is independent of the other groups already in existence and will be populated

Fig. 1.5 Robotic Surgery Facebook Group

Table 1.2 Anchoring procedures for Robotic Surgery pathway

Robotic Surgery anchoring procedure by pathway	Level
Biliary	
Multi-port cholecystectomy	Competency
Cholecystectomy with IOC or for uncomplicated acute cholecystitis	Proficiency
Cholecystectomy for difficult/severe acute cholecystitis or common bile duct exploration (CBDE)	Mastery
Foregut	
Nissen fundoplication	Competency
Paraesophageal Hernia Repair or Heller Myotomy	Proficiency
Redo fundoplication	Mastery
Hernia	
Primary ventral hernia repair	Competency
Primary inguinal hernia repair	Proficiency
Redo hernia or complex hernia (transversus abdominis release)	Mastery
Bariatric	
Sleeve gastrectomy or lap band	Competency
Roux-en-Y gastric bypass	Proficiency
Revisional bariatric surgery	Mastery
Colorectal	
Right colectomy	Competency
Left colectomy	Proficiency
Left colectomy with splenic flexure release, colectomy for complex inflammatory disease or advanced cancer	Mastery

only by physicians, mostly surgeons or surgeons in training interested in a wide range of robotic surgery applications.

The group provides an international platform for surgeons and healthcare providers interested in optimizing outcomes in a surgical specialty to collaborate; share; discuss; and post photos, videos and anything related to a chosen specialty. By embracing social media as a collaborative forum, we can more effectively and transparently obtain immediate global feedback that potentially can improve patient outcomes, as well as the quality of care we provide, all while transforming the way a society's members interact.

For the first two levels of the MASTERS Program, Competency and Proficiency, participants will be required to post videos of the anchoring procedures and will receive qualitative feedback from other participants. However, for the mastery level, participants will submit a video to be evaluated by an expert panel. A standardized video assessment tool, depending on the specific procedure, will be used. A benchmark will also be utilized to determine when the participant has achieved the mastery level for that procedure.

Once the participant has achieved mastery level, he will participate as a coach by providing feedback to participants in the first two levels. MASTERS program participants will therefore need to learn the fundamental principles of surgical coaching. The key activities of coaching include goal setting, active listening,

powerful inquiry, and constructive feedback [5, 6]. Importantly, peer coaching is much different than traditional education, where there is an expert and a learner. Peer coaching is a "co-learning" model where the coach is facilitating the development of the coached by using inquiry (i.e., open-ended questions) in a non-competitive manner.

Surgical coaching skills are a crucial part of the MASTERS curriculum. At the 2017 SAGES Annual Meeting, a postgraduate course on coaching skills was developed and video recorded. The goal is to develop a "coaching culture" within the SAGES MASTERS Program, wherein both participants and coaches are committed to lifelong learning and development.

The need for a more structured approach to the education of practicing surgeons as accomplished by the SAGES MASTERS program is well recognized [7]. Since performance feedback usually stops after training completion and current approaches to MOC are suboptimal, the need for peer coaching has recently received increased attention in surgery [5, 6]. SAGES has recognized this need and its MASTERS Program embraces social media for surgical education to help provide a free, mobile, and easy-to-use platform to surgeons globally. Access to the MASTERS Program groups enables surgeons at all levels to partake in the MASTERS Program curriculum and obtain feedback from peers, mentors, and experts. By creating surgeon-only private groups dedicated to this project, SAGES can now offer surgeons posting in these groups the ability to discuss preoperative, intraoperative, and postoperative issues with other SAGES colleagues and mentors. In addition, the platform permits transparent and responsive dialogue about technique, continuing the theme of deliberate, lifelong learning.

To accommodate the needs of this program, SAGES University is upgrading its web-based features. A new learning management system (LMS) will track progression and make access to SAGES University simple. Features of the new IT infrastructure will provide the ability to access a video or lecture on-demand in relation to content, level of difficulty, and author. Once enrolled in the MASTERS Program, the LMS will track lectures, educational products, MCE, and other completed requirements. Participants will be able to see where they stand in relation to module completion and SAGES will alert learners to relevant content they may be interested in pursuing. Until such time that the new LMS is up and running, it is hoped that the SAGES Manual will help guide learners through the MASTERS Program Curriculum.

Conclusions

The SAGES MASTERS Program ROBOTIC SURGERY PATHWAY facilitates deliberate, focused postgraduate teaching and learning. The MASTERS Program certifies completion of the curriculum but is NOT meant to certify competency, proficiency, or mastery of surgeons. The MASTERS Program embraces the concept of lifelong learning after fellowship and its curriculum is organized from basic principles to more complex content. The MASTERS Program is an innovative, voluntary curriculum that supports MOC and deliberate, lifelong learning.

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