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Special REPORT

After Five Years-The Application and Validation of Robotic-Assisted Surgery Through Inguinal Hernia Repair and Across the Spectrum of General Surgery

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Similar to the way laparoscopy transformed the approach to many surgical conditions, the advent of robotic-assisted surgery represents a shifting paradigm in the general surgery landscape. In fact, the rapid adoption of robotic-assisted surgery calls for a way to connect the pioneers of the robotic-assisted modality with surgeons seeking to expand the application of minimally invasive surgery (MIS) throughout their hernia repair practice (Figure 1).[1] In September 2017, organizers of the 2-day general surgery CONNECT Robotics Forum sought to fulfill this need. The forum moderator, Yuri Novitsky, MD, FACS, director of the Columbia Hernia Center at Columbia University, described the symposium as "a unique gathering designed to lay a foundation for the integration of robotic-assisted surgery across the field of general surgery instead of reserving it for specific types of operations." Alfredo M. Carbonell, DO, FACS, FACOS, a professor of surgery at Greenville Health System, said the CONNECT Robotics Forum provided an opportunity for a "select group of people who already understand the viability and benefit of robotic-assisted surgery, to connect with faculty and each other to go deeper into their robotic-assisted surgery practice." Surgeons emphasized the developing interest. "We have all witnessed the growth in robotic-assisted surgery over the past 4 to 5 years," said Nisha S. Dhir, MD, FACS, a general surgeon at the University Medical Center of Princeton. "People are excited to get on board and don't want to be left behind."

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The da Vinci® Surgical System is a robotic-assisted surgery platform that offers surgeons 3-D, high-definition magnified visualization; wristed instrumentation that articulates beyond the capabilities of the human hand to help facilitate dissection and suturing; and an ergonomic solution (eg, surgeons sit while operating).[2] During the CONNECT Robotics Forum, a panel of highly experienced surgeons participated in a roundtable discussion on the benefits of minimally invasive robotic-assisted surgery with the da Vinci system they have observed, their individual paths to robotic-assisted surgery, and how it has expanded and changed their practices. The expert panel, moderated by Conrad Ballecer, MD, a general surgeon at the Center for Minimally Invasive and Robotic Surgery, discussed recently published data on robotic-assisted surgery and, importantly, the "all-in" mentality that drove their adoption of the da Vinci system.

Expanding MIS as a Surgical Option

The panelists agreed that they can now offer robotic-assisted surgery to appropriate patients because, according to Dr. Carbonell, robotic-assisted surgery provides "the benefits of MIS with the integrity of an open procedure." Sandeep S. Vijan, MD, FACS, chief of surgery and director of robotic surgery at the Parkview Medical Center, added that "straight-stick laparoscopic tools are not good enough to tackle high-acuity problems in a minimally invasive fashion," a limitation that the robotic-assisted platform may help overcome.

Eugene Dickens, MD, FACS, a general surgeon from Utica Park Clinic Central, elaborated. "Inguinal hernia repair was previously an open procedure for me. In addition, we can offer procedures that were extremely difficult to do laparoscopically. Transversus abdominis release (TAR) was never really a laparoscopic procedure until it was performed with robotic assistance," he said.

Robotic-assisted procedures offered by the roundtable panelists include inguinal hernia repair (IHR), ventral hernia repair (VHR), hiatal hernia repair, paraesophageal hernia repair, and more complex procedures such as retromuscular repair with TAR, revisional bariatrics, and abdominal wall reconstruction. The population undergoing these procedures now includes elderly patients, patients whose risk for wound infection may be too high for open procedures, and obese patients.

"Before robotic-assisted surgery, elderly patients with hiatal hernias were often less likely to be referred for surgery," Dr. Dhir said. Now that minimally invasive robotic-assisted surgery is an option for her, she expects her practice to include more elderly patients seeking MIS. "The area of greatest growth that I have seen is in hiatal and paraesophageal hernias, especially in octogenarians and nonagenarians. It is amazing how well they have done. This is not something I would have considered doing 5 years ago. Regarding large inguinal scrotal hernias—those were not procedures I would have tackled laparoscopically, but with the robot I feel very comfortable performing them minimally invasively and see great results," she said. Dr. Carbonell added, "My desire to use the robotic-assisted platform was 2-fold: robotic-assisted retromuscular incisional hernia repair and reoperative foregut surgery. I think robotic-assisted surgery is the best way to perform large paraesophageal hernia

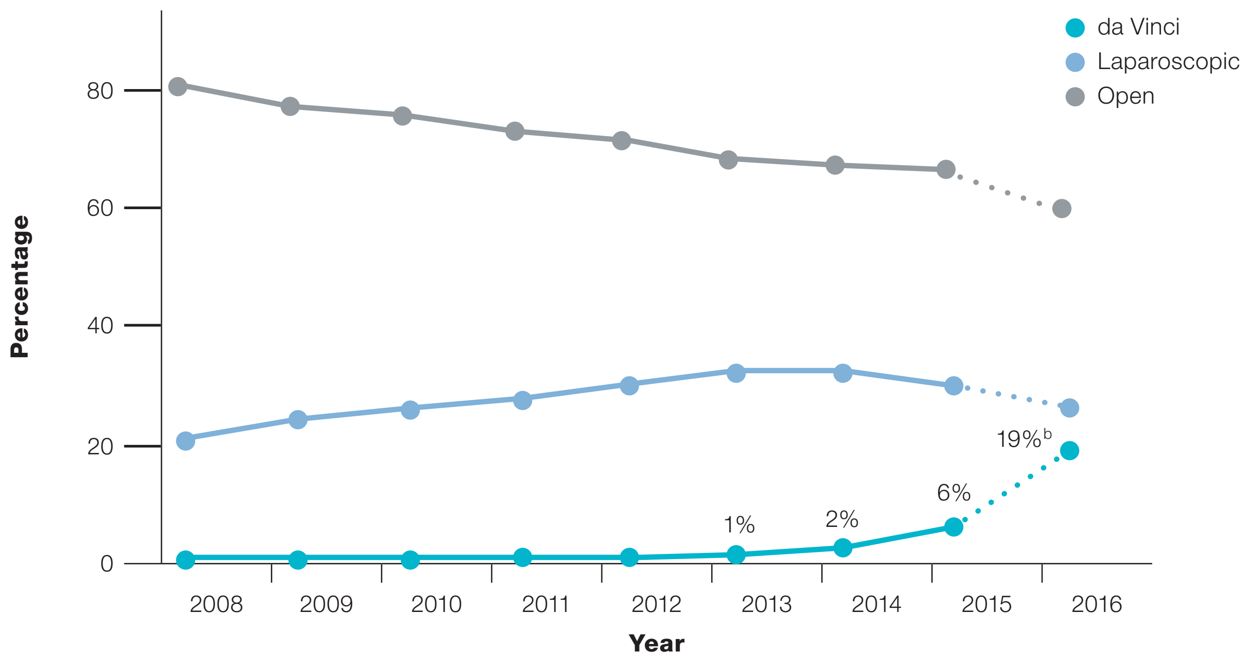

Figure 1. National trends in hernia repair by surgical approach.[a]

[a] Based on Q1 2008 through Q3 2015 Premier data listing ventral or inguinal hernia repair as the primary procedure. The data are not collected under formalized study. The data have not been peer reviewed and have not been published.

[b] Open and laparoscopic surgery 2016 market penetration projections based on Intuitive Surgical internal estimates. da Vinci Surgery 2016 market penetration projection based on Goldman Sachs financial model on 02/06/16.

Based on reference 1.

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repairs with intrathoracic stomach, and Heller myotomies."

Dr. Carbonell noted that adoption of the da Vinci system not only broadened his MIS practice, but it has improved his surgical skills overall. "The heightened visual sense has made me so much more aware that I have changed the way I operate," he explained. "The articulated motion, the ease of getting in and around the esophagus, doing the dissection, getting very high up into the chest, and the increased visual acuity I believe have made me a better surgeon."

Dr. Carbonell also highlighted, from his perspective, the favorable ergonomics and favorable patient outcomes with the da Vinci system. "The ergonomics—being able to sit down to perform complicated procedures—and the robotic-assisted approach compared with the laparoscopic approach is beneficial from a discharge standpoint with a 1-day shorter median length of stay (LOS) for ventral hernia patients (Figure 2).[3,4] That is a slam dunk for us."

Since implementing the da Vinci system, panelists reported increasing technical proficiency, as well as expanding the scope of MIS offerings within their practice. These changes are particularly evident in their IHR and VHR practices.

Clinical Experience With the da Vinci System for Inguinal Hernia Repair

Open and laparoscopic IHRs are common procedures with surgeons performing more than 600,000 each year in the United States.[5] Although the laparoscopic approach has been available for decades, its adoption rate for hernia repair has plateaued between 20% and 30%.[1] Thus, an alternative modality could potentially provide an opportunity to increase the number of repairs performed in a minimally invasive manner.

Surgeons often believe that competence should be quickly achieved in these procedures, and consider them "first-year or second-year cases," Dr. Dickens said. However, panelists attested to the challenges of laparoscopic totally extraperitoneal (TEP) repair, difficulty approaching inguinal anatomy laparoscopically, and consequently performing open inguinal repairs instead of MIS procedures. The adoption of robotic-assisted surgery into their practices has helped overcome their barriers to MIS inguinal hernia repair, and made MIS repair available to more appropriate candidates.

"It has been an interesting process for me to learn the robotic-assisted technique and to see very clearly that the benefit to my patients is really, really significant," Dr. Dickens said. "To do a minimally invasive inguinal hernia repair instead of an open repair, and to walk that path with other surgeons, for them to open up and say, 'Yes, the anatomy is confusing to me, and I am afraid of where to put fixation,' and to recognize that there are inadequacies is humbling (Figure 3)."

Dr. Dhir also described how robotic-assisted surgery helped overcome her prior discomfort with laparoscopic inguinal anatomy. "I was an open inguinal hernia surgeon until 2015. I did everything else minimally invasively, robotically, but I was uncomfortable with the anatomy of laparoscopic inguinal repair, and knew of the challenges of a laparoscopic TEP repair," she said. "After hearing about the great results that people were having with robotic-assisted repair, I finally ventured into it. It

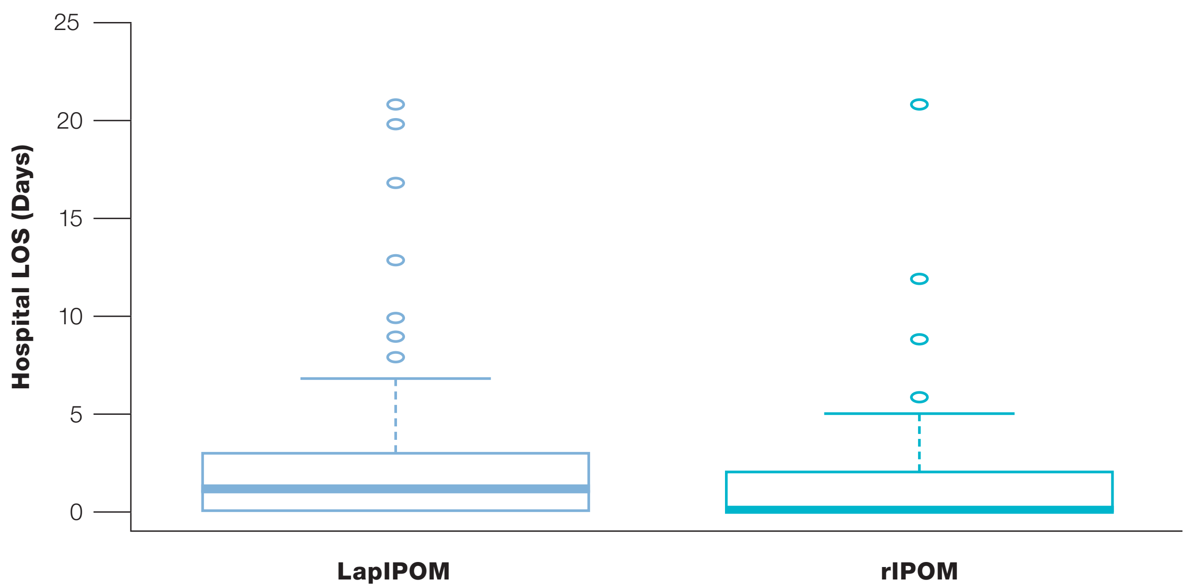

Figure 2. Hospital stay in patients undergoing LapIPOM versus rIPOM.

Median LOS is shown with *P*<0.001 between both groups (mean LOS 1 day [LapIPOM patients] vs 0 days [rIPOM patients]; *P*<0.05). Each box plot represents data from propensity score–matched groups (454 LapIPOM vs 177 rIPOM patients), with outlier values removed (ie, values higher than the third quartile value + 1.5*IQR). Box plots show the IQR (boxes), median, 1.5*IQR (whiskers).

IQR, interquartile range; **LapIPOM,** laparoscopic intraperitoneal mesh placement; **LOS,** length of stay; **rIPOM,** robotic-assisted intraperitoneal mesh placement

Based on reference 3.

Published by *J Am Coll Surg*, 225(2), Prabhu AS, Dickens EO, Copper CM, et al. Laparoscopic vs robotic intraperitoneal mesh repair for incisional hernia: an Americas Hernia Society Quality Collaborative analysis, 285-293, 2017, with permission from Elsevier.

has been an area of substantial growth in my practice. For me, it is highly reproducible, and I no longer have discomfort with the anatomy. I use da Vinci for large inguinal scrotal repairs that I previously repaired open."

For Clark Gerhart, MD, FACS, director of minimally invasive surgery and robotics at Wilkes-Barre General Hospital, the da Vinci system empowered him to perform inguinal repairs, including large inguinal scrotal hernias, minimally invasively. "The robot is better laparoscopy. I can see tissue planes more clearly due to the enhanced visualization. The ergonomics help, and the wristed instruments help enable dissection. It allows me to do bigger hernias with incarceration, even with strangulation, without a second thought as to whether I can perform the procedure minimally invasively."

Clinical Experience With the da Vinci System for Ventral Hernia Repair

VHR is a common procedure with surgeons performing between 350,000 and 500,000 each year in the United States.[6] Despite the ubiquity of VHRs, the portion performed laparoscopically is only between 20% and 30%.[1] Panelists expressed dissatisfaction with the limitations of laparoscopic repair. For example, laparoscopic closure of primary fascial defects can be tedious, and thus surgeons often default back to open procedures. However, open procedures are associated with significant wound morbidity.[7,8] Robotic-assisted surgery helps overcome these challenges by facilitating defect closure (Figure 4).

Dr. Ballecer became increasingly dissatisfied with laparoscopic VHR. "What exactly was I doing?" he asked. "Was I just patching a hole to prevent incarceration or was I actually fixing a hernia? I abandoned laparoscopic VHR and started doing everything open." He was inspired, however, by the advent of robot-assisted VHR, which allowed him to "reproduce an open technique and provide MIS benefit to my patients." Since then, "my ventral hernia practice has completely changed. This is where robotic-assisted surgery has had the greatest impact."

Dr. Vijan shared a similar experience. "VHR was the reason I started my robotic-assisted surgery career," he said. "I was trained in laparoscopic VHR and, for the longest time, was

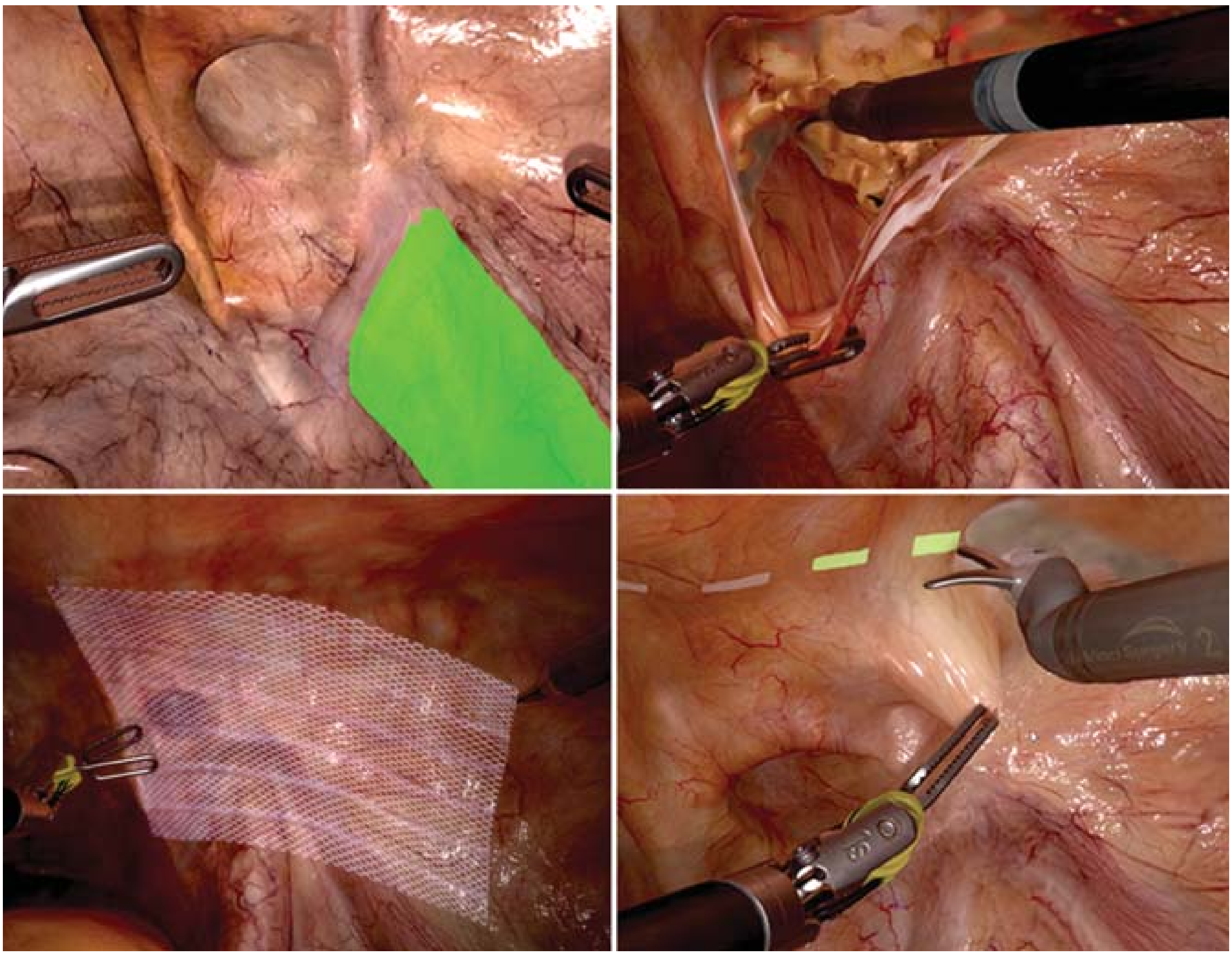

Figure 3. The all-new inguinal hernia procedural simulation by 3D Systems is now available on the da Vinci® Skills Simulator™.

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completely dissatisfied with the procedure. It was a step forward in terms of decreasing wound morbidity compared with open surgery, but we were just patching a hole. I started doing robotic-assisted surgery with a healthy dose of skepticism. It was not until I started going down the path of abdominal wall reconstruction preperitoneal approaches that I experienced a watershed moment with the technology, and realized that this was not possible in my hands laparoscopically. But it is possible, and may be reproducible on a mass scale, if we embrace the technology."

The Watershed Moment

The watershed moment signified more than an understanding of the technical feasibility of robotic-assisted surgery and a discovered capacity to perform procedures on the robotic-assisted platform. For the panelists, it meant realizing that the da Vinci system could potentially produce better surgical outcomes.

"On average, my laparoscopic VHR patients would spend at least 1 night in the hospital," Dr. Vijan said. "I would tell patients that this is a small-scar surgery, but you're going to hurt because of how the mesh is secured. Now, even if I use a giant piece of mesh—20 by 25 cm or 30 by 30 cm—I've had TAR patients go home from the post-anesthesia care unit significantly sooner. That's really what got me. I could not believe that pain scores were cut in half for my patients," Dr. Vijan said.

The da Vinci system helped enable the surgeon panelists to undertake procedures they previously performed with reservations. The robotic-assisted platform facilitates minimally invasive inguinal hernia repair by helping surgeons better visualize the anatomy, and in robotic-assisted procedures, ventral hernia fascial defects can be closed instead of patched. In addition, as described below, the literature is confirming clinical observations of improved outcomes.

Supporting Data

Multiple single-center and multicenter studies of robotic-assisted surgery have emerged over the last few years.[3,4,9-14] Although Dr. Novitsky noted a need for data demonstrating the long-term durability of robotic-assisted repairs, he stated that robotic-assisted surgery can no longer be considered a fad. "We looked at our early experience with robotic-assisted TARs and compared with an open cohort to put on paper what we were seeing. It was obvious to me how much better people were doing," Dr. Novitsky said (Table 1).[10] "The argument that there are no data on robotic-assisted surgery has subsided. Two years ago, it was valid. Now, I don't think it's debatable. It is a fast-moving train that is picking up speed. The people who still think robotic-assisted surgery is going to fade away are undoubtedly in danger of being left far, far behind," he said.

Several important VHR studies have been published in the last year,[3,4,9,10] 2 of which came from the Americas Hernia Society Quality Collaborative (AHSQC).[3,4] "The beauty of the 2 AHSQC publications, which looked at laparoscopic versus robotic-assisted IPOM [intraperitoneal mesh placement] and robotic-assisted versus open retromuscular repair," said Dr. Carbonell, "is that that they were done by a multitude of people, from multiple backgrounds, at multiple institutions and hospitals, with different payor mixes, with or without enhanced recovery after surgery protocols, and different nuances in technique. Nevertheless, there is a clear benefit for the robot in both of those approaches.[3,4] The data are unequivocally there."

The first AHSQC initiative compared outcomes between 177 robotic-assisted and 454 laparoscopic case-matched IPOM patients with incisional hernias. In this registry analysis, median hospital LOS was 1 day in the laparoscopic group versus 0 days in the robotic-assisted surgery group ($P<0.001$) (Figure 2). Laparoscopy was associated with a higher incidence of surgical site occurrences than robotic-assisted surgery (14% vs 5%; $P=0.001$), although there was no difference in the incidence

Figure 4. Ventral hernia defect closure.

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of occurrences requiring procedural intervention (1% vs 0%, respectively; *P*=1). Overall, patients in the robotic-assisted group experienced significantly fewer complications (Table 2).[3]

Dr. Carbonell speculated that the shorter hospital LOS among patients undergoing robotic-assisted surgery may be related to reduced tissue trauma and the method of mesh fixation. “Robotically, there is less tugging and pulling on the abdominal wall than there is laparoscopically; it’s a finer motion,” he said. “Undeniably, the fixation must also contribute to the difference between laparoscopic IPOM and robotic-assisted retromuscular repair. There’s something about the tacks and pinpoint fixation that you’re sort of obligated to do laparoscopically because you have 5-mm trocars and 5-mm piercing fixation devices—that is somehow different than in a big retromuscular dissection with minimal fixation in the retromuscular plane.”

A second AHSQC study—a propensity score-matched analysis—compared the outcomes of 111 patients who underwent robotic-assisted retromuscular VHR with 222 patients who underwent open repair between 2013 and 2016. Median hospital LOS was significantly shorter among patients who underwent robotic-assisted repair. Results did not reveal differences in 30-day readmission rates or surgical site infections. More surgical site occurrences, mostly seromas not requiring intervention, were observed in the robotic-assisted patients.[4]

“Open and robotic-assisted VHR are the same exact operation, but when you do not open the abdominal cavity and you do not have insensible fluid losses, they become markedly different procedures,” Dr. Carbonell said. “Even though robotic-assisted procedures may require more operating time, patients still do better robotically.”[4,10] Dr. Novitsky added that unlike open procedures, robotic-assisted surgery does not expose the abdominal cavity to room air and does not require constant retraction of the rectus muscles, which also may contribute to improved outcomes, including wound morbidity and postoperative pain.

Data sets on robotic-assisted IHR are also emerging with several studies demonstrating feasibility and fewer complications.[11-14] Kolachalam and colleagues reported that robotic-assisted inguinal repair is associated with fewer complications than open repair in obese patients,[11] and several retrospective and single-center studies showed that robotic-assisted IHRs produce outcomes similar to those achieved with laparoscopy, and that the robotic-assisted platform may facilitate repairs, including complex cases.[12-14] An ongoing multicenter, randomized clinical trial is comparing laparoscopic and robotic-assisted IHR.[15] Researchers hypothesize that robotic-assisted repair will yield better postoperative outcomes than conventional laparoscopic repair.[15] However, panelists agreed that even if the trial shows no difference, they would not change their current approach. “As a surgeon, you do what you do well for your patients. I perform a robotic-assisted TAPP [transabdominal preperitoneal] inguinal quicker and more efficiently than laparoscopic TAPP. I’m going to do what is best for the patients in my practice. Simple. That’s it. I don’t need the data to convince me,” Dr. Vijan said.

Table 1. Comparison of Intraoperative and Postoperative Outcomes

	R-TAR (n=38)	O-TAR (n=76)	*P* Value
Intraoperative			
Synthetic mesh implanted	100%	100%	1.0
Operative time, min	299 ± 95	211 ± 63	<0.001
Blood loss, mL	49 ± 60	139 ± 149	<0.001
Complications	0	0	1.0
Postoperative			
Blood transfusion, %	0	6.57	0.106
SSE	1 (2.6%)	9 (11.8%)	0.101
SSI	0	5 (6.6%)	0.106
Complications	0	13 (17.1%)	0.007
Mortality	0	0	1.0
In-hospital stay, d	1.3 ± 1.3	6 ± 3.4	<0.001

O-TAR, open transversus abdominis release; **R-TAR,** robotic-assisted transversus abdominis release; **SSE,** surgical site event; **SSI,** surgical site infection

Based on reference 10.

Surg Endosc, Comparative analysis of perioperative outcomes of robotic versus open transversus abdominis release, Epub ahead of print, 2017, Martin-del-Campo LA, Weltz AS, Belyansky I, et al, with permission of Springer.

The All-in Mentality

Panelists advocated a full commitment to the da Vinci technology to maximize its potential and produce the most desired surgical outcomes, and suggested that dabbling will not yield the skills necessary to apply the technology to a broad range of cases. Thus, the surgeons emphasized an all-in mentality instead of only using the robotic-assisted platform for specific types of procedures (eg, only IHR). Right colectomy, hiatal hernia repair, cholecystectomy, sleeve gastrectomy, and sigmoid colectomy are among the numerous procedures for which the surgeon panelists are using robotic-assisted surgery. When robotic-assisted surgery is incorporated into a practice, the panelists recommend that surgeons strive for proficiency and fully commit to its use.

“As the technology improved and I saw the value of the ergonomics and visualization, the greater precision of my dissection, I felt that this was a better way for me to do all of my MIS. To do that, I had to master the technology,” Dr. Dhir said. “If I dabble in it, if I leave it for my hardest cases, then I’m never going to reach that level of proficiency that I might have either open or laparoscopically. So if I recognize that this is a better way for me to do MIS, then I have to commit to ensuring that I’m the best trained in the technology that I can be.”

Dr. Ballecer agreed. “Once my partner and I decided to make the switch to robotic-assisted surgery, we dove all in; everything we used to do laparoscopically we are now doing with the robot. We concluded very early on that robotic-assisted surgery was easier for us and it felt like we were doing a better job. There was no dabbling. Once we dove in, we were full speed ahead.”

Dr. Vijan fully embraced the technology early on. “I was all-in on day one; I made the conscious decision to get good at it—to study the interface, figure out how to be efficient and use the ergonomics advantageously, and determine the limits. What can I not do? I figured out that once you get through the interface—the learning curve, so to speak—there's very little that you cannot do with this machine," he said.

"Robotic-assisted surgery is laparoscopy performed with improved instrumentation," Dr. Novitsky said. "Therefore, adopting an all-in mentality makes a lot of sense. Repetition leads to proficiency and proficiency drives excellence. As other panelists have shared, applying robotic-assisted surgery across their practices has had a tremendous positive impact on them and their patients."

Recommendations for Building a Robotic-Assisted Surgery Program

The roundtable participants offered step-by-step advice for general surgeons beginning their da Vinci system journey:

1. Define your goals, Dr. Vijan said. Goals may include increasing the percentage of MIS being performed at an institution through the use of the new technology, or using the robotic-assisted platform as an enticement for recruiting new physicians and operating room staff.
2. Elect a surgeon champion to chair the program—someone interested in the technology and its clinical applications, and who can liaise with staff and administration as the program grows.
3. Establish a multidisciplinary robotic-assisted surgery steering committee as most robotic-assisted surgeons eventually will operate with their urology and gynecology colleagues, and their input is necessary.
4. Commit to a case series and track your data. Metrics such as clinical outcomes, pain scores, hospital LOS, conversions, complications, and costs provide surgeons, staff, and administration the conviction to continue growing the practice and improve efficiencies.
5. Explore opportunities with Intuitive Surgical, which has a wealth of resources, such as mentoring, proctoring, advanced technique training, webinars, and an all-around dedicated staff. "I have connected with surgeons throughout the country in my efforts to help them with robotic-assisted surgery," Dr. Vijan said. "These relationships would not be possible without the infrastructure that Intuitive has in place. We all live in a connected world and we need to be able to continually seek help from our peers."

Table 2. Intraoperative and Postoperative Complications Following Laparoscopic and Robotic-Assisted Intraperitoneal Mesh Repair for Incisional Hernias

	Intraperitoneal Mesh Placement		
Complication	**Laparoscopic (n=452)**	**Robotic-Assisted (n=186)**	***P* Value**
Any complication, n (%)	84 (19)	14 (8)	<0.001
Pain	2	1	1
Pulmonary embolism	1	0	1
Stroke	0	0	
Deep vein thrombosis	2	0	1
Sepsis	0	0	
Septic shock	0	0	
Myocardial infarction	0	0	
Cardiac arrest	0	0	
Urinary tract infection	1	0	1
Renal failure	1	0	1
Pneumonia	3	1	1
Endotracheal intubation	2	0	1
Death	0	1	0.2915
Ileus	8	1	1
Intraoperative complication	4	4	1
Bowel injury	4	0	0.02
Hemorrhage requiring transfusion	0	1	0.02
Readmission	19	5	0.4
Reoperation	8	0	0.1128
Other complication	19	1	0.0120

Values are numbers unless otherwise noted.

Based on reference 3.

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da Vinci System Training

Dr. Carbonell is the current president of the Americas Hernia Society (AHS), and said the March 2018 joint AHS/European Hernia Society meeting in Miami, Florida, will present excellent opportunities to receive mentored training on the da Vinci system. "We are offering a 2-day hands-on course to take people that are not robotically trained, train them, and then introduce them to minimally invasive robotic-assisted techniques. In addition, there is another subset of people already trained that might want to learn some more advanced robotic-assisted techniques," he said. "It's going to be pretty exciting."

Conclusion

Robotic-assisted hernia repair with the da Vinci system is rapidly advancing across the country.[1] Growing evidence demonstrates that robotic-assisted hernia repair is not only feasible and safe, but it is associated with some outcomes that are comparable or favorable to those obtained with laparoscopy and open surgery, including shorter hospital LOS and fewer complications.[3,4,9-14] Robotic-assisted surgery has increased the types of MIS procedures the surgeon panelists offer, and expanded the access to MIS for a wider population of patients. Additionally, the enhanced visualization, ergonomics, and dexterity helps facilitate complex surgical procedures.[11,12,14] The panelists emphasized, however, that successful implementation of robotic-assisted surgery requires a full commitment to routine use of the technology. "In my hands, anything I can do laparoscopically I can do better robotically. For that reason, I'm all in," Dr. Dhir said.

References

1. Data on file. Sunnyvale, CA: Intuitive Surgical; 2016.
2. da Vinci Surgical System. www.intuitivesurgical.com/products/davinci_surgical_system/. Accessed December 18, 2017.
3. Prabhu AS, Dickens EO, Copper CM, et al. Laparoscopic vs robotic intraperitoneal mesh repair for incisional hernia: an Americas Hernia Society Quality Collaborative analysis. *J Am Coll Surg*. 2017;225(2):285-293.
4. Carbonell AM, Warren JA, Prabhu AS, et al. Reducing length of stay using a robotic-assisted approach for retromuscular ventral hernia repair: a comparative analysis from the Americas Hernia Society Collaborative. *Ann Surg*. 2017 Mar 27. [Epub ahead of print]
5. Society of American Gastrointestinal and Endoscopic Surgeons. Laparoscopic inguinal hernia repair surgery patient information from SAGES. www.sages.org/publications/patient-information/patient-information-for-laparoscopic-inguinal-hernia-repair-from-sages. Accessed December 18, 2017.
6. Society of American Gastrointestinal and Endoscopic Surgeons. Laparoscopic ventral hernia repair surgery patient information from SAGES. www.sages.org/publications/patient-information/patient-information-for-laparoscopic-ventral-hernia-repair-from-sages/. Accessed December 18, 2017.
7. Colavita PD, Tsirline VB, Walters AL, et al. Laparoscopic versus open hernia repair: outcomes and sociodemographic utilization results from the nationwide inpatient sample. *Surg Endosc*. 2013;27(1):109-117.
8. Mason RJ, Moazzez A, Sohn HJ, et al. Laparoscopic versus open anterior abdominal wall hernia repair: 30-day morbidity and mortality using the ACS-NSQIP database. *Ann Surg*. 2011;254(4):641-652.
9. Gonzalez A, Escobar E, Romero R, et al. Robotic-assisted ventral hernia repair: a multicenter evaluation of clinical outcomes. *Surg Endosc*. 2017;31(3):1342-1349.
10. Martin-del-Campo LA, Weltz AS, Belyansky I, et al. Comparative analysis of perioperative outcomes of robotic versus open transversus abdominis release. *Surg Endosc*. 2017 Jul 21. [Epub ahead of print]
11. Kolachalam R, Dickens E, D'Amico L, et al. Early outcomes of robotic-assisted inguinal hernia repair in obese patients: a multi-institutional, retrospective study. *Surg Endosc*. 2017 Jun 23. [Epub ahead of print]
12. Kudsi OY, McCarty JC, Paluvoi N, et al. Transition from laparoscopic totally extraperitoneal inguinal hernia repair to robotic transabdominal preperitoneal inguinal hernia repair: a retrospective review of a single surgeon's experience. *World J Surg*. 2017;41(9):2251-2257.
13. Arcerito M, Changchien E, Bernal O, et al. Robotic inguinal hernia repair: technique and early experience. *Am Surg*. 2016;82(10):1014-1017.
14. Escobar Dominguez JE, Ramos MG, Seetharamaiah R, et al. Feasibility of robotic inguinal hernia repair, a single-institution experience. *Surg Endosc*. 2016;30(9):4042-4048.
15. ClinicalTrials.gov. Role of robotic platform in inguinal hernia surgery. www.clinicaltrials.gov/ct2/show/NCT02816658. Accessed December 18, 2017.

Important Safety Information

Surgical risks for paraesophageal and other hiatal hernia repairs include gastric, duodenal, or esophageal perforation, herniation of wrap, dysphagia, pneumothorax, esophageal stricture, hiatal hernia, gas bloat syndrome, delayed gastric emptying, heartburn, and reflux. Surgical risks for hernia repair (ventral, incisional, umbilical, inguinal) include recurrence, bowel injury, mesh infection, and urinary retention. For inguinal hernia repair, surgical risks include testicular injury. Serious complications may occur in any surgery, including da Vinci® Surgery, up to and including death. Examples of serious or life-threatening complications, which may require prolonged and/or unexpected hospitalization and/or reoperation, include but are not limited to, one or more of the following: injury to tissues/organs, bleeding, infection and internal scarring that can cause long-lasting dysfunction/pain. Risks specific to minimally invasive surgery, including da Vinci® Surgery, include but are not limited to, one or more of the following: temporary pain/nerve injury associated with positioning; a longer operative time, the need to convert to an open approach, or the need for additional or larger incision sites. Converting the procedure could result in a longer operative time, a longer time under anesthesia, and could lead to increased complications. Contraindications applicable to the use of conventional endoscopic instruments also apply to the use of all da Vinci instruments. For Important Safety Information, indications for use, risks, full cautions and warnings, please also refer to http://www.davincisurgery.com/safety and http://www.intuitivesurgical.com/safety. Individual surgical results may vary.

Disclosures: Dr. Ballecer reported that he is a consultant to CR Bard and Intuitive Surgical. Dr. Carbonell reported that he has received honoraria from Intuitive Surgical. Dr. Dhir reported that she is a consultant to Intuitive Surgical. Dr. Dickens reported that he is a consultant to Covidien and Intuitive Surgical. He also is on the speakers' bureau for Intuitive Surgical and owns shares of GIBLIB. Dr. Gerhart reported that he is a consultant to Intuitive Surgical. Dr. Novitsky reported that he is a consultant to Cooper Surgical, CR Bard, and Intuitive Surgical. He also is on the speakers' bureau for CR Bard and Intuitive Surgical. Dr. Vijan reported that he is a consultant to, and has received honoraria from Intuitive Surgical.

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