

**MINIMALLY INVASIVE SURGERY WEEK**  
**SLS • MIRA • SRS JOINT ANNUAL MEETING**  
**STATE OF THE ART LECTURES IN ROBOTIC SURGERY ABSTRACTS**

**Wednesday, September 5, 7:30am-3:30pm**

**Robot-Assisted Minimally Invasive Esophagectomy: Personal Experience**

Abbas Abbas, MD

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**Introduction:** Esophagogastrectomy is the standard operation for operable esophageal carcinoma. It is also indicated for end-stage benign esophageal disease. Although open approaches, such as combined laparotomy-thoracotomy (Ivor Lewis Procedure) and combined laparotomy-cervicotomy (Transhiatal Esophagogastrectomy) are the most commonly employed techniques for this operation. In the last decade, minimally invasive esophagogastrectomy by means of video assisted thoracoscopy and laparoscopy have been shown to be safe and efficacious. The use of robotic-assistance may add certain benefits to this approach including improved visualization and handling of tissues. Our study aims to evaluate our early experience in robotic-assisted minimally invasive esophagogastrectomy (RAMIE) using a combined robotic thoracoscopy-laparoscopy and cervicotomy (Robotic McKeown Procedure).

**Methods:** A retrospective chart data review of all patients who underwent RAMIE for esophageal adenocarcinoma of the esophagogastric junction between January 2011 and June 2012 was performed. We excluded 7 other patients who underwent the same procedure during that period for different diagnoses including end-stage achalasia with megaesophagus (4), giant esophageal diverticulum (1), esophageal squamous cell carcinoma of the proximal esophagus (2).

**Results:** Thirty patients (29 males) were identified who underwent RAMIE for esophageal adenocarcinoma of the esophagogastric junction. Median age was 62 years (40-74). Fourteen patients (47%) had neoadjuvant radiation and chemotherapy and of those, 6 patients (40%) had a complete pathological response with no evident tumor in the resected specimen. One patient (3%) had definitive chemoradiation therapy and required a salvage procedure for residual cancer. Successful completion of the robotic procedure was possible in all patients (100%) with no conversion to open thoracotomy or laparotomy. Mean operative time (skin to skin) was 320 minutes (260-430). Mean number of lymph nodes harvested was 18 (7-44). No deaths occurred at any time in this series. Other early complications included anastomotic leak (3, 10%), pneumonia (4, 13%), atrial fibrillation (4, 13%), and chylothorax (1, 3%). All anastomotic leaks were asymptomatic, discovered only on postoperative esophagography. All were managed expectantly and resolved within 4 weeks of the procedure. Delayed complications include stricture formation requiring anastomotic dilation in 4 patients (13%) and delayed gastric emptying in 1 patient (3%), which also required pyloric dilation for resolution. The median length of hospital stay was 7 days (range 4-31) and was 5 days or less in 12 patients. Follow-up is complete for all patients, and at a mean follow-up of 5.5 months all 30 patients are alive. Two patients have had recurrence including malignant peritoneal deposits and lung metastasis.

**Conclusions:** RAMIE is feasible with comparable results to other techniques. It has been shown to be safe and associated with acceptable outcomes, including short hospital stay and low incidence of complications. Comparative effectiveness studies to other techniques are necessary to further evaluate this procedure, especially in regards to long-term results.

**Variations on Robot-Assisted Laparoscopic Radical Cystectomy: Partial Cystectomy, Prostate-Sparing Cystectomy, and Vaginal-Sparing Cystectomy**

Piyush K. Agarwal, MD

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National Cancer Institute at the National Institutes of Health

Radical cystectomy (RC) is the first-line therapy for the treatment of muscle-invasive bladder cancer as well as refractory cases of high grade, non-muscle-invasive disease. However, it is a highly morbid procedure and has been known to adversely impact both urinary and sexual functions. Standard RC requires complete removal of the bladder in addition to bilateral pelvic lymphadenectomy. In men, the seminal vesicles and prostate are also removed; whereas in women, the uterus, vagina,

and bilateral ovaries are also removed as these organs may harbor disease and serve as a source for recurrent tumor. Although removal of the sexual/reproductive organs with the bladder and lymph nodes provides the greatest chance for oncologic cure, it comes with the price of functional morbidities such as infertility, sexual dysfunction, impotence, and urinary incontinence. Even in the best hands with nerve-sparing techniques, the rates of urinary incontinence and erectile dysfunction could be as high as 30% and 80%, respectively. To minimize the risk of urinary incontinence and impotence without compromising oncological efficacy, many strategies such as partial cystectomy (PC), vaginal-sparing radical cystectomy (VSRC), and prostate-sparing radical cystectomy (PSRC) have evolved. While these approaches may not be appropriate for all patients, many contemporary series have reported superior urinary continence and potency rates in addition to comparable oncological outcomes in carefully selected group of patients. In this presentation, I will present the indications and techniques of these surgical variations on robot-assisted laparoscopic cystoprostatectomies and anterior pelvic exenterations.

### State of the Art in Robotic Telesurgery

Mehran Anvari, MB BS PhD

In the present era of telecommunications and computer technology, the way we live in both our professional and private environment has radically changed. Automation and robotics has been used extensively in several fields of industry as well as extreme environments. More recently, robotics has extended to the field of medicine with the development of complex applications in surgical robotic systems. One of the primary advantages robotics brings to the field of surgery is telesurgery; enabling the surgeon to operate on a remotely situated patient. This presentation will focus on the past, current, and future applications of telesurgery and the challenges which need to be overcome to allow telesurgery to become a routine application of surgical robots.

### State of the Art in Robotic Coronary Bypass Surgery

Johannes Bonatti, MD

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Since its introduction in 1998 robotic endoscopic coronary artery bypass grafting has developed from placement of single left internal mammary artery bypass grafts to the left anterior descending artery to performance of complex multi-vessel revascularization procedures. In 2012 robotic harvesting of the internal mammary artery (IMA) is routine, skeletonization seems to be the most appropriate technique. Bilateral IMA harvesting is well feasible. Procedures are carried out with or without use of the heart lung machine. The graft to coronary anastomosis can be performed through a minithoracotomy under direct vision using classic surgical instruments or in completely endoscopic fashion using the operation robot. The latter version of the procedure is called TECAB (Totally Endoscopic Coronary Artery Bypass). If the heart lung machine is used remote access cannulation techniques and sophisticated methods to arrest the heart are applied. If the procedure is performed on the beating heart an endostabilizer is used for local immobilization of the target vessel. In TECAB the graft to target vessel connection is carried out using regular suture, nitinol clips, or automatic anastomotic connectors. According to published data in the literature perioperative mortality is in the 1% range and meets safety standards of open surgery through sternotomy. TECAB-conversion rates to larger incisions have dropped from an initial 20% to 30% range into single digit percentages. Current data show acceptable overall morbidity and fast postoperative recovery after robotic coronary surgery.

### State Of The Art In Robotic Bariatric Surgery

Carlos A. Galvani, MD

The field of minimally invasive bariatric surgery has seen significant growth in recent years and has led to new and innovative surgical options for the treatment of morbid obesity. Herein we discuss the evolution of robotic surgery, the current role of robotics in bariatric surgery, review current data, and discuss the role that robotics will have in bariatric surgery in the future.

Since 2000, robotic systems have revolutionized minimally invasive surgery. However, its ultimate role in bariatric surgery was unclear because early outcomes appeared to be similar to standard laparoscopy. For those reasons, its adoption was not widespread. But after a decade of experience and numerous clinical studies, it has become clear that this cutting-edge technology consistently yields better morbidity and mortality than traditional, minimally invasive surgery. Additional advantages include improved ergonomics and dexterity in super-obese patients. These technical advantages along with the clinical benefits and the shorter learning curves reported, have fostered the rapid development of robotic bariatric surgery.

The implementation of new instrumentation such as robotically controlled-staplers, vessel sealing devices and the single

incision platform will certainly increase its adoption by bariatric surgeons. Perhaps the miniaturization of the next generation of robotic surgical systems will be the enabling technology facilitating complex surgical maneuvers that surgeons are faced with while performing natural orifice surgery or single port surgery.

Robotic surgery has already proven to be of great value, particularly in complex surgical procedures. Undoubtedly, robotics will have a significant role in the future of general and bariatric surgery.

### State of the Art Robotic Cardiac Surgery in China (550 Cases)

A Single Surgeon and Single Center Experience

Changqing Gao, MD

Ming Yang, MD, Gang Wang, MD, Yang Wu, MD, Cangsong Xiao, MD

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**Objective:** To summarize the experience of 550 cases of robotic heart surgery performed with da Vinci surgical system in China.

**Methods:** five hundred and fifth patients underwent robotic cardiac surgery from January 2007 to July 2012 in PLA General Hospital. The patients were divided into 2 groups according to the approach of ports. The procedures in group I included totally endoscopic coronary artery bypass graft on beating heart(TECAB, 88 cases), endoscopic atraumatic coronary bypass graft on beating heart (122 cases), and hybrid robotic coronary artery bypass graft(22 cases), and the procedures in group II were the robotic mitral valve repair or replacement(140 cases), totally robotic myxoma excision(49 cases), totally endoscopic atrial septal defect closure(84 cases), tricuspid valve repair (12 cases)and totally robotic repair of partial anomalous pulmonary veins connection with pulmonary stenosis ( 1 case), VSD repair(20 cases). In group I, the patients were operated on via left lateral approach, Via 3 port incisions in the left chest and 1 port in the left subcostal area of xiphoid process for endostabilizer. The TECAB on beating heart were completed with the da Vinci S or Si robot, and the others were completed via left minithoracotomy after IMA was taken down robotically. The mean age was 58.8±9.4 years old (33 to 78 years old), the mean weight was 61.8±12.0 kg (40 to 86 kg) and the mean height was 168.9±6.4 cm (150 to 181cm). In group II, the patients were operated on via right lateral approach. Via 3 ports in the right chest and a 1.5-2.0 cm working port, all the procedures were completed with the da Vinci S or Si robot. The mean age was 38.6±14.8 years old (11 to 75 years old), the mean weight was 61.8±12.0 kilogram (31 to 91 kg) and the mean height was 164.2±8.4 cm (144 to 181cm), in which atrial septal defect repair were performed on beating heart heart in 50 cases. **Results:** All patients had successful operations. There were no operative deaths or other complications. One patient was reexplored for bleeding in the trocar site, 1 patient had hemolysis after mitral valve repair. There was no intraoperative conversion to alternative approach, and there were no da Vinci system-related adverse events. All the cases were followed up. **Conclusions:** Our study shows that da Vinci cardiac surgery is safe procedure in selected patients, and the surgical results are excellent.

**Key words:** Minimally invasive cardiac surgery, Robotics, Cardiac surgery; da Vinci S

### State of the Art in Robotic Myomectomy

Antonio R. Gargiulo, MD

Director of Robotic Surgery, Center for Infertility and Reproductive Surgery, Brigham and Women's Hospital, Harvard Medical School, Boston.

Laparoscopic myomectomy is advantageous in terms of reproductive outcome and appears just as safe in terms of resulting obstetrical outcome when compared to its abdominal counterpart. Despite this, there has been an unacceptably slow adoption of this procedure by the surgical community at twenty years from its introduction. This is due to the undeniable fact that there are serious ergonomic challenges to the adoption of laparoscopic myomectomy. Robotic surgical platforms are scientifically proven ergonomic enablers that address these challenges and decrease operator workload. Advincula and collaborators invented robotic myomectomy and shared their clinical results with the medical community in 2004, just months before the FDA clearance of the current robotic surgical system for gynecologic surgery. Since then, robotic myomectomy has become one of the most rapidly adopted robotic procedures across all surgical specialties. This brief presentation will review the most significant scientific publications on robotic myomectomy and will share the extensive experience of our subspecialty unit with the many variations of this technique: over 600 consecutive robotic myomectomies without a single conversion to laparotomy to date. Highlights of this presentation will be the hybrid robotic myomectomy for very large tumors, the single incision robotic myomectomy, the “cosmetic” setup of the robot to avoid any visible scars above

the lower quadrants and the use of flexible laser fibers to limit myometrial thermal damage.

### State of the Art in Robotic Lung Surgery

Farid Gharagozloo, MD

Results from the National Lung Screening Trial have shown a significant reduction in lung cancer mortality with annual low dose CT Screening among former smokers. In this large study CT screening led to a 20% decrease in the rate of death from lung cancer. (NEJM 5/29/2011).

Although screening by Computerized Tomography (CT) has been shown to improve overall survival in patients with lung cancer, patients with early stage lung cancer go undiagnosed. As a result, the majority of patients with early stage lung cancer who can undergo potentially curative surgical resection are not treated.

Due to the morbidity associated with thoracotomy practitioners are reluctant to refer patients to surgery and choose a “watch and wait” approach. Consequently in order for the screening strategy to the diagnosis of early stage lung cancer to succeed early diagnosis needs to be coupled with minimally invasive surgical resection which replicates gold standard oncologic techniques. Robotic Lobectomy for lung cancer has been shown to be highly efficacious and safe (Gharagozloo et. al. Ann. of Thoracic Surgery, 2008, 2009) It is the only minimally invasive technique which completely replicates the gold standard oncologic technique of lobectomy by thoracotomy. Combining a strategy of screening diagnosis with Robotic minimally invasive resection of lung cancer at an early stage holds the audacious promise of affecting the very epidemiology of the most deadly cancer in both men and women.

This presentation will outline the current techniques and results with Robotic Lobectomy.

### State of the Art Robotic Kidney Surgery

Jacques Hubert, Prof Dr Med

Thanks to its now well-known advantages, robotics allows surgeons to enhance their laparoscopic skills and to perform meticulously different kinds of operation.

The robotic mini-invasive approach can be proposed for most surgical renal procedures:

simple nephrectomies, radical nephrectomies as well as more challenging ones such as some T2 tumors or ureteronephrectomies; delicate steps of nephron-sparing surgery are widely facilitated and large series have now proven the interest of the high-quality vision and endowristed instruments.

Living donors, healthy patients who undergo surgery without benefit for themselves, can be offered a technique which allows the most meticulous dissection.

UPJ syndrome treatment also takes high advantage from robotics. This approach can be indicated even if crossing vessel, redundant pelvis, associated calculi, recurrent stenosis, and horseshoe kidney.

Other procedures such as pyelolithotomy, calyceal diverticulectomy, and surgery of duplex or ectopic kidneys... are also facilitated by robotics.

Precise preoperative evaluation is mandatory for best outcome in this kind of surgery with vascular hazard. If well analyzed, multislice CT scans different image reconstructions (MIP, 3D...) allow anticipating most of the anatomical pitfalls.

From the beginnings of robotic surgery at the end of the 1990's up to now, continuous technical improvements have followed one another (new instruments, 4th arm, HD vision...); numerous others are under development and will continue to modify kidney robotic surgery.

Development of robotic skills requires specific training, and new technologies such as simulators may improve not only developing basic skills but also allow patient specific procedures training in the future.

Enhancing the surgeon's technical capabilities, robotics improves the adaptation of the surgical treatment to the clinical case (and not the technical possibilities), particularly for kidney surgery.

### State of the Art in Robotic Kidney Surgery

Thomas W. Jarrett, MD

The past 20 years have shown a dramatic change in the minimally invasive treatment of renal masses. Laparoscopic nephrectomy was initially slow to incorporate into mainstream urology but eventually gained widespread acceptance. Over the same time period, partial nephrectomy was establishing itself as the standard for small renal masses in patients with normal contra-lateral kidneys. Originally, these techniques were slow to incorporate into mainstream urology due to the

technical challenges of the procedure with warm ischemia and the advanced skills needed for intra corporeal tumor excision and urinary tract reconstruction. Initial cases were limited to selected cases with small and peripheral exophytic tumors. Newer robotic assisted techniques have led to more widespread use and incorporation of much more complex tumors. With further advances, open tumor excision may be limited for only highly complex central tumors and multifocal disease.

This lecture will show the evolution of robotic partial nephrectomy from small limited series of tumors of low complexity to tumors of high complexity. At our institution alone, we have seen partial nephrectomy evolve from a majority laparoscopic approach for less complex cases and open surgical for highly complex cases to largely a robotic assisted approach for even the most challenging cases. These advances have been made possible by a combination of advances in techniques, instrumentation and technologies for tumor localization.

### State of the Art in Robotic Thyroid Surgery: BABA Thyroid Surgery

Kyu Eun Lee, MD, PhD

Since bilateral axillo-breast approach (BABA) endoscopic thyroidectomy was introduced in 2004, much improvement has been achieved in thyroidectomy in terms of both oncologic concept and surgical completeness. This was mainly attributed to the introduction of da Vinci Robotic system which facilitates sophisticated movement using endowrists of high degree range of motion and high definition 3D image. In addition to the established merits of BABA endoscopic thyroidectomy, BABA robotic system enables large mass removal and lymph node dissection which are difficult with endoscopic technique. Indication of BABA robotic thyroidectomy in SNUH are 1) patients with low risk well-differentiated thyroid cancer, 2) patients with Graves' disease, 3) patients with benign thyroid nodule sized from 5 cm to 8 cm, and 4) male patients who indicated for endoscopic thyroid surgery.

From February 2008 to February 2012, we performed 1026 BABA robotic surgeries. Out of these, 865 patients underwent BABA robotic total thyroidectomy with central lymph node dissection for PTC. The proportion of the patients who showed less than 1ng/ml in Tg level at 3 months post-surgery was 99.4% of 392 patients who did not need RAI treatment and 63.2% of 441 patients who underwent RAI treatment. Transient hypocalcemia was present in 355(41%) patients and permanent hypocalcemia in 13(1.5%). Transient vocal cord palsy was present in 129(14.9%) patients and permanent palsy in 3(0.3%). In conclusion BABA robotic total thyroidectomy with central lymph node dissection is an effective and safe method to manage low risk thyroid carcinomas.

### State of the Art in Robotics, Colorectal

Elisabeth C. McLemore, MD, FACS, FASCRS

The aim of the presentation is to review the latest technology available for utilization in robotic colorectal surgery including robotic fluorescence imaging and robotic simulation. Currently, the da Vinci® surgical system is the only robotic system available for use in minimally invasive gastrointestinal surgery. Robotic fluorescence imaging allows assessment of arterial blood flow and lymphatic blood flow that can assist in improving operative outcomes. A dye, Indocyanine Green (ICG), is administered intravenously and then activated by infrared light. The robotic camera view can then be switched back and forth between standard real time images and images illuminated by the dye. This technology may improve post-operative outcomes including reduced anastomotic leak rate and selection of patients for diversion after low pelvic anastomosis.

Robotic surgical training has involved mostly animal models and / or inanimate objects. There are four virtual reality robotic surgical simulators currently available: RoSS™, dV-Trainer™, SEP Robot™, and da Vinci® Skills Simulator™. Each robotic system possesses a varying degree of face, content, and construct validity published in the literature. All of the systems have basic skill sets with performance analysis and metrics software. However, most robotic systems do not contain specific surgical procedural components at this time.

With the dramatic rise in interest in robotic gastrointestinal surgery over the past few years, it is imperative that the surgical community integrate and collaborate with our colleagues in industry in order to ensure patient safety, and provide more effective, streamlined, and consistent surgical education and assessment of robotic surgical skills.

### State of the Art in Robotic Pediatric Surgery

John J. Meehan, MD, FACS

It has been 10 years since the first published reports of robotic surgery in children emerged. However, the growth in pediatric surgery has been slow. A lot of this stagnation has been attributed to the difficulties with instrument size compared to small children. Little has been done to downsize instrumentation, overall robot size, or any other modifications that may improve the appeal of robotic surgery to pediatric surgeons. Despite these limitations, more and more robotic series in children

continue to emerge with very promising outcomes. The number of procedures which have been completed in children robotically is huge with a seemingly unlimited variety of congenital and acquired pediatric conditions.

The accuracy and precision of robotic surgery can be particularly beneficial in infants and small children. While MIS surgeons have been pushing the envelope with non-articulating instruments in the hopes of bringing the benefits of MIS to patients with challenging conditions such as biliary atresia and congenital diaphragmatic hernia, the results using standard MIS instruments has been less than ideal. Meanwhile, these same procedures performed robotically have shown promising success and appear to be superior to standard MIS in early series. These observations are helping to promote a resurgence of excitement in pediatric robotic surgery.

### State of the Art in Robotic Hysterectomy

Camran Nezhat, MD

Laparoscopic Hysterectomy with and without a Robot: Stanford Experience

Camran Nezhat, MD, Ofer Lavie, MD, Madeleine Lemyre, MD, Ofer Gemer, MD, Lisa Bhagan, MD, and Ceana Nezhat, MD

Abstract Objective:

To compare robotic-assisted laparoscopic hysterectomy (RALH) with a matched control group of standard laparoscopic hysterectomy (LH).

Methods:

A retrospective chart review of all RALH was performed. All cases were compared with a matched control group of standard LH. Comparisons were based on Fisher's exact, Mann-Whitney, and exact chi-square tests.

Results:

Between January 2006 and August 2007, 26 consecutive RALH were performed (10 with bilateral salpingo-oophorectomy). These were compared with 50 matched control standard LH (22 with bilateral salpingo-oophorectomy). The 2 groups were matched by age ( $P=0.49$ ), body mass index ( $P=0.25$ ), gravidity ( $P=0.11$ ), previous abdomino-pelvic surgery ( $P=0.37$ ), and size of the excised uterus ( $P=0.72$ ). Mean surgical time for RALH was 276 minutes (range, 150 to 440) compared with 206 minutes (range, 110 to 420) for standard LH ( $P=0.01$ ). Blood loss, hospitalization length, and postoperative complications were not significantly different. No conversion to laparotomy was reported in either group.

Conclusion:

Robotic technology was successfully used for hysterectomy with a similar surgical outcome to that of standard LH. This technology offers exciting potential applications, especially for remote telesurgery, and to facilitate teaching of endoscopic surgery.

Keywords: Robot, da Vinci, Hysterectomy, Laparoscopy, Gynecology, Surgery

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### State of the Art in Robotic Colon and Rectal Surgery

Vincent Obias, MD

George Washington University, Washington, DC

Robotics in Colon and Rectal Surgery has greatly expanded beyond just proctectomies. Initial randomized controlled trials such as the MRC-CLASSIC trial demonstrated a high conversion to open rate for laparoscopic low anterior resections for cancer (34%) as well as worse circumferential margins and increased nerve damage. Seminal papers such as Baik and Kim et al. helped demonstrate significantly reduced conversions to open ( $p<0.05$ ) and improved total mesorectal dissections. Multiple randomized studies such as ROLARR are ongoing which hope to further validate robotics for rectal surgery.

While the majority of papers and data focus on the utility of robotics in curable rectal cancer, new technologies such as near infrared/firefly have been added. This powerful new tool can help surgeons identify well perfused bowel, which may help reduce anastomotic complications. Other new technologies such as the robotic cut/seal and the upcoming bowel stapler will further help surgeons operate in difficult fields such as the pelvis. New techniques are also starting to appear such as single incision robotic colectomies and robotic transanal surgery. The robot is particularly helpful when doing these types of surgeries due to increased degrees of freedom of the robotic instruments and 3D visualization. Robotics in colon and rectal surgery has advanced greatly over these last few years, and the future is bright.

## State of the Art in Robotic Mitral Valve Repair in a Beating Heart

Allen Raczkowski, MD

As mitral valve repair has evolved utilizing minimally invasive robotic techniques, the complexity of the procedure has increased. Multiple techniques for arresting the heart have required increasingly complex strategies and may have an impact on the adoption of robotic repair. In an attempt to simplify the procedure, the technique of beating heart repair was utilized in starting a new robotic mitral repair program at the University of Arizona. Using standard cardiopulmonary bypass with cannulation of the femoral artery and vein, the mitral valve was exposed from the R chest using standard robotic ports. No aortic vents were placed and the R chest air is replaced with CO<sub>2</sub> infusion at 3L per min. The heart is allowed to beat. Exposure of the valve is enhanced with a LA retractor and a pump sucker controlled by the tableside surgeon. Standard repair techniques were used for repair including neo chords, resection, edge to edge and reduction annuloplasty. Flexible rings were used and placed with a running technique. Results for 23 consecutive patients: mortality 0.0% (expected 1.9%), observed mortality + morbidity 11.1% (expected 17.1%), O/E for combined M&M 0.65. Follow-up echo demonstrate mild or no MR.

## State of the Art in Robotic Otolaryngology-Head and Neck Surgery

Nader Sadeghi, MD

George Washington University

In the last 60 years, the field of pharyngeal and laryngeal cancer care has undergone several and significant shifts in management. The field has evolved into a multidisciplinary approach to management, employing complex and often multimodality therapeutic approaches, using surgery, radiotherapy, biological therapy, and systemic chemotherapy. Although effective oncologically, intensive chemoradiotherapy protocols result in significant long-term morbidities to the patient.

Transoral minimally invasive surgery in head and neck oncology, using Transoral Laser Microsurgery (TLM), and further enhanced by Transoral Robotic Surgery (TORS) provides new opportunities for effective head and neck cancer care with functional preservation of the involved organ.

For laryngeal cancer, the concepts of compartmentalization, efficacy of narrow margin surgery, and efficacy of multi-block surgical resection, have allowed TLM and TORS to emerge as effective treatments for early and moderately advanced laryngeal cancer. For early supraglottic cancer, unimodality surgical treatment with TLM and TORS stands to provide the highest quality of voice outcome, while providing oncologic cure. For early oropharyngeal cancer TORS is highly effective as a unimodality treatment. For moderately advanced oropharyngeal cancer, TORS combined with adjuvant radiotherapy provides opportunity for oncologic efficacy, while avoiding long term sequelae of intensive chemoradiation.

Transoral surgery enhanced by robotic, microscopic, and laser technology, as well as improved understanding of genetic prognosticators for head and neck cancer, is resulting in a therapeutic turn towards surgery and leading the way for a new paradigm shift in treatment of this cancer.

## State of the Art in Robotic Gynecologic Oncology Surgery

Daniel H. Smith, MD

Robotic surgery defines the best in cancer care for most women with gynecologic cancers. As opposed to other disciplines, surgery is often the best and only way of providing initial therapy for malignant diseases such as cancers of the uterus, cervix, and ovary. The adaptation of the robotic platform to the care of these patients has transformed the patient's experience – less discomfort, quick recovery, best outcome of treatment.

Robotic surgery was designed for other specialties. Some found it a rapid advance in certain procedures; others found limited applicability and/or adoption.

Adopting the robotic platform came somewhat late to gynecology. Although diagnostic and operative laparoscopy had become the 'new best care,' using the robot instead of or in addition to laparoscopic techniques seemed daunting. A few pioneers in benign gynecology took up the challenge with success. Then, almost overnight, gynecologic oncologists adapted and adopted the robotic platform, initially for cervical and uterine cancers. With familiarity and facility, the realm of problems solved with use of the robotic platform increased.

Today, in addition to patients with cervical or uterine cancers, the robotic platform is increasingly used for patients with complex adnexal masses, early ovarian cancer, upper abdominal gynecologic metastases, and treatment of disease or treatment complications, such as bowel obstructions. As with other surgical specialties, the use of the robotic platform is

extending while improving patient satisfaction and outcome.

The future in robotic surgery for use in a gynecologic oncology practice is bright not only for surgery but for other oncologic techniques. Use of the robotic platform for shielded/unshielded intra-operative radiation therapy may change the paradigm of cancer care to include intra-operative care of larger lesions – primary or metastatic. We look to future investigations and developments.

### State of the Art in Robotic Vascular Surgery

Petr Štádlr, Assoc. Prof., MD, PhD

Department of Vascular Surgery, Na Homolce Hospital, Prague, Czech Republic

**BACKGROUND** – Our clinical experience with robot-assisted aortoiliac reconstruction for occlusive diseases, aneurysms, and hybrid procedures performed using the da Vinci system is herein described.

**METHODS** – Between November 2005 and November 2011, we performed 225 robot-assisted laparoscopic aortoiliac procedures. 174 patients were prospectively evaluated for occlusive diseases, 43 patients for abdominal aortic aneurysm, two for a common iliac artery aneurysm, two for a splenic artery aneurysm, three for hybrid procedures, and one for endoleak II treatment post EVAR.

The robotic system was applied to construct the vascular anastomosis, for the thromboendarterectomy, for the aorto-iliac reconstruction with a closure patch, for dissection of the splenic artery, and for the posterior peritoneal suture. A combination of conventional laparoscopic surgeries and robotic surgeries were routinely included. A modified, fully-robotic approach without laparoscopic surgery was used in the last 55 cases in our series.

**RESULTS** – 217 cases (96%) were successfully completed robotically, one patient's surgery was discontinued during laparoscopy due to heavy aortic calcification. In seven patients (3%) conversion was necessary. The thirty-day mortality rate was 0,4%, and non-lethal postoperative complications were observed in ten patients (4,4%).

**CONCLUSIONS** – Our experience with robot-assisted laparoscopic surgery has demonstrated the feasibility of this technique for aortoiliac vascular and hybrid procedures. The da Vinci robotic system facilitated the creation of the aortic anastomosis, and shortened the aortic clamping time as compared to purely laparoscopic techniques.

### State of the Art in Robotic Prostatectomy

Ash Tewari, MD

Anatomical grades of nerve sparing: a risk-stratified approach to neural-hammock sparing during robot-assisted radical prostatectomy (RARP).

Tewari AK, Srivastava A, Huang MW, Robinson BD, Shevchuk MM, Durand M, Sooriakumaran P, Grover S, Yadav R, Mishra N, Mohan S, Brooks DC, Shaikh N, Khanna A, Leung R.

Source

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Abstract

**OBJECTIVES:**

• To report the potency and oncological outcomes of patients undergoing robot-assisted radical prostatectomy (RARP) using a risk-stratified approach based on layers of periprostatic fascial dissection. • We also describe the surgical technique of complete hammock preservation or nerve sparing grade 1.

**PATIENTS AND METHODS:**

• This is a retrospective study of 2317 patients who had robotic prostatectomy by a single surgeon at a single institution between January 2005 and June 2010. • Included patients were those with  $\geq 1$  year of follow-up and who were potent preoperatively, defined as having a sexual health inventory for men (SHIM) questionnaire score of  $>21$ ; thus, the final number of patients in the study cohort was 1263. • Patients were categorized pre-operatively by a risk-stratified approach into risk grades 1-4, where risk grade 1 patients received nerve-sparing grade 1 or complete hammock preservation and so on for risk grades 2-4, as long as intraoperative findings permitted the planned nerve sparing. • We considered return to sexual function post-operatively by two criteria: i) ability to have successful intercourse (score of  $\geq 4$  on question 2 of the SHIM) and ii) SHIM  $>21$  or return to baseline sexual function.

**RESULTS:**

• There was a significant difference across different NS grades in terms of the percentages of patients who had intercourse and returned to baseline sexual function ( $P < 0.001$ ), with those that underwent NS grade 1 having the highest rates (90.9% and 81.7%) as compared to NS grades 2 (81.4% and 74.3%), 3 (73.5% and 66.1%), and 4 (62% and 54.5%). • The overall positive surgical margin (PSM) rates for patients with NS grades 1, 2, 3, and 4 were 9.9%, 8.1%, 7.2%, and 8.7%, respectively ( $P = 0.636$ ). • The extraprostatic extension rates were 11.6%, 14.3%, 29.3%, and 36.2%, respectively ( $P < 0.001$ ). • Similarly, in patients younger than 60, intercourse and return to baseline sexual function rates were 94.9% and 84.3% for NS grade 1 as compared to 85.5% and 77.2% for NS grades 2, 76.9% and 69% for NS grades 3, and 64.8% and 57.7% for NS Grade 4 ( $P < 0.001$ ).

#### CONCLUSIONS:

• The risk-stratified approach and anatomical technique of neural-hammock sparing described in the present manuscript was effective in improving potency outcomes of patients without compromising cancer control. • Patients with greater degrees of NS had higher rates of intercourse and return to baseline sexual function without an increase in PSM rates.

#### State of the Art in Robotic Hepatobiliary Surgery

Matthew Walsh, MD

The current state of robotics in HPB surgery is one of excitement for an unrealized potential. Advanced HPB procedures represent a high potential synergy with robotics. The transition of major open procedures to minimally invasive procedures can be facilitated by robotics where laparoscopic-only adaptation has been poorly accepted. Thus, the most advanced procedures lend themselves best to robotic adaptation. This is likely best demonstrated in pancreaticoduodenectomy where several major groups have described complete robotic and hybrid laparoscopic procedures. The experience to date suggests that when performed by surgeons proficient in open HPB resections, and advanced laparoscopic and robotic skills, Whipple procedures can be performed with acceptable operative and oncologic outcomes. It remains a challenge to select the best patient for this procedure such as the obese patient who is more likely to benefit from less wound and pulmonary complications. Unique outcomes should also be considered compared to prior eras, such as earlier entry into adjuvant trials following minimally invasive procedures. Biliary operations amenable to robotic adaptations remain an interesting challenge. Routine robotic cholecystectomy does not currently exist as a viable financial option with the current generation of robots. Lower profile, simpler procedure specific robots could alter this equation. Short of these advances, robotics for cholecystectomy are currently entertained for single and alternate site techniques. The current platform for single site robotic cholecystectomy has its challenges to overcome before wide-spread acceptance. Advanced, but infrequent procedures such as resection of proximal cholangiocarcinomas and choledochocysts are particularly well-suited for robotics. Advances in robotic instrumentation will aid use of robotics in liver resectional surgery. Many of the advances in liver surgery are from advances in devices. It remains to be seen if robotic resections are improved compared to laparoscopy, but it would change the paradigm for surgeons who persist in hand-assisted liver resections.

#### State of the Art of Robotic Bariatric Surgery

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Obesity is a growing nationwide epidemic that continues to challenge policymakers and clinicians alike. Bariatric surgery has proven to be a safe and effective treatment of obesity, and the field has evolved rapidly in the past decade as surgeons have adopted new methods and techniques. One recent technological advancement in bariatric surgery has been the introduction of the da Vinci Surgical System. Compared to traditional laparoscopy, the da Vinci provides surgeons with improved visualization, dexterity, and ergonomics.

Case series and studies published to date have demonstrated the technical feasibility of the da Vinci for use in Roux-on-Y gastric bypass, sleeve gastrectomy, gastric banding, and duodenal switch. A recent review of the literature has shown robotic bariatric surgery to be a safe option, reporting an all-robotic complication rate of 10.2% compared with 12.6% for traditional laparoscopy. Comparisons of procedure time yielded mixed results, likely due to variability of operative technique in difference studies. Randomized trials with larger patient numbers are required to determine whether use of robotics can significantly impact long-term patient outcomes.

Other issues must be addressed before robotics can be considered for widespread clinical practice in bariatrics. The high cost associated with the adoption and use of robotic surgery must be compared to potential cost savings through improved patient outcomes and decreased stapler use. Additionally, while the da Vinci can offer improved visualization and ergonomics for bariatric surgeons, these advantages come at the expense of lost haptic feedback and a nontrivial operator learning curve.