Following a long tradition, the Engineering and Urology Society will update the participants on newest developments in technology which are continually changing medical practice. The meeting serves as a forum where individuals from academia, industry and clinical practice can discuss challenges and formulate ideas for new instruments and clinical approaches.

The EUS holds its 25th annual meeting on Saturday, May 29th, 2010 in San Francisco, CA. Organized by the program chairmen Stephen Nakada and Sean Hedican, the sessions will focus on new imaging or monitoring interfaces, such as image guided renal surgery, photodynamic assisted bladder tumor resection or new methods to improve the outcome of shock wave lithotripsy. The "Fantastic Voyage" of robotics in urology will include presentations on remote robotic surgery, image robotic guided prostate needle interventions, and intra-cavitary magnetic robots and instruments. The European section will present advances in Laparoscopic Single-Site surgery (LESS) and assess actual und future armamentarium such as flexible instruments and steerable platforms. The status of robotic surgical devices offering haptic sense will be presented as well as recent developments of virtual reality surgical simulation in laparoscopic, endoscopic and percutaneous training. The meeting will also cover aspects and new developments of Natural Orifice Translumenal Endoscopic Surgery (NOTES) in urology. The Society invites all delegates to join us with this fascinating program.

The review of the abstracts for the poster sessions has been performed online by a group of 95 reviewers from around the world. Each paper received between 19 and 24 independent reviews. We would like to thank the reviewers, listed at the end of this program book, for their constructive comments and essential contribution to the quality of the meeting.

The Best Paper Award was selected for the abstract with the highest review score average. The award goes to an industry-academia collaboration paper by Dr. Shravanthi Reddy and his colleagues on a “Micro-Patterned Surfaces for the Reducing the Risk of Catheter-Associated UTI”. Because the science reported this year has been overwhelmingly novel and significant, the society also presents four Outstanding Paper awards.

We gratefully thank all reviewers for their hard work, objective scoring, and contribution to the success of the meeting. The society presents Best Reviewer Awards for the online review process, based on the scoring performance and the number of reviews performed. The Best Reviewer Awards are presented to Drs. Thorsten Bach, Jean de la Rosette, Wareef Kabbani, Salvatore Micali, Sutchin Patel, Koon Ho Rha, Autorino Riccardo, Kazuo Suzuki and Kevin Zorn.

We congratulate all award winners and welcome all urologists, engineers, and scientists to join us for this unique multi and interdisciplinary experience. As always, we are grateful to Dr. George Nagamatsu, the founder and first president of the society for setting the foundations based upon which we meet.

Please visit the web site of the EUS, http://engineering-urology.org for a complete version of this program including the abstracts presented. The abstracts are also scheduled to appear in the October 2010 issue of the Endourology Journal. The abstracts from the 2008 EUS meeting were published in November 2008 pages 2583-2640 and the 2009 abstracts will appear in August 2010.

Thank you for your continued scientific support,

Jens Rassweiler
Dan Stoianovici
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6:45 - 7:15 Registration

7:15 – 7:30 Stryker Fellow Report
Mostafa Sadek

7:30 – 8:30 Session 1: New Imaging or Monitoring Interfaces with Urologic Therapy
Stephen Nakada
Sean Hedican
7:30 AM Ferro-Particles: A New Advance in Stone Manipulation
Jeffrey Cadeddu
7:45 AM HIFU – Update 2010
Christian Chaussy
8:00 AM An Insight in Urological Imaging in Europe
Jochen Walz
8:15 AM Photodynamic Assisted Bladder Tumor Detection and Resection
Tim O’Brien

8:30 – 9:30 Session 2: “The Fantastic Voyage” – 2010 Update on Robotics in Urology
Stephen Nakada
Sean Hedican
8:30 AM Robotic Image Guided Renal Surgery
Duke Herrell
8:45 AM Robotic Platform and Equipment Horizons
David Albala
9:00 AM Remote Robotic Surgery: Challenges of Technology
Benjamin Lee
9:15 AM Imaged Guided Robotic Renal and Prostate Needle Interventions
Dan Stoianovici

9:30 – 11:00 Session 3: ESUT Session- “LESS and Beyond – Assessment of Actual and Future Armamentarium”
Jens Rassweiler
Claude Abbou
9:30 AM Motorized 6-DOF- Instruments
Gunter Janetschek
9:45 AM Flexible vs Pre-Bent Instruments
Evangelos Liatsikos
10:00 AM LESS – Monomodal or Hybrid
Roland van Velthoven
10:15 AM The New Radius-Device
Marc Schurr
Jan T. Klein
10:30 AM Steerable LESS-Platform (Spider)
Jens Rassweiler
10:45 AM Ways to Tactile Feedback
Thomas Frede

11:00-11:45 Session 4: Virtual Reality (VR) Surgical Simulation
Stephen Nakada
Sean Hedican
11:00 AM Status & Existing Challenges of VR Simulation in Laparoscopic Surgery
Robert Sweet
11:15 AM Utility of VR Laparoscopic Simulation in Residency and Concentrated Training Courses
Elspeth McDougall
11:30 AM VR Endoscopic and Percutaneous Training Models in Stone Surgery – How Good are They?
Margaret Pearle

11:45–12:00 Awards Presentation
Dan Stoianovici
11:50 AM Best Paper Award: Micro-Patterned Surfaces for the Reducing the Risk of Catheter-Associated UTI
Shravanthi Reddy

12:00 –1:00 PM Lunch (Hilton Continental Ballroom 5)
Jay Bishoff
Key Note Lecture:
“Surgical Technology: From the Battlefield to the Bedside”
**1:00–4:30 PM**  
**Session 5: LESS and NOTES**  
*(Natural Orifice Transluminal Endoscopic Surgery)*  
Matthew Gettman  
Abhay Rane

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<td>3:08 PM</td>
<td>What’s In, What’s Out</td>
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<td>LESS from a Beginner’s Standpoint: My First Case</td>
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<td>3:24 PM</td>
<td>NOTES: What have We Achieved to Date</td>
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Urology NOTES Working Group Business Meeting

**2:00 – 4:00 PM**  
Imaged Guided Therapy Working Group (Hilton Continental Ballroom 5)

**4:00-5:00PM**  
Stent Working Group (Hilton Continental Ballroom 5)

**POSTER SESSIONS:**

**1:00–2:30PM**  
**Poster Session 1**  
– Session 1A  
(Hilton Continental Parlor 1)  
– Session 1B  
(Hilton Continental Parlor 2&3)

- Jens Rassweiler  
- Lee Richstone  
- Misop Han  
- Thorsten Bach

**3:00–4:30PM**  
**Poster Session 2**  
– Session 2A  
(Hilton Continental Parlor 1)  
– Session 2B  
(Hilton Continental Parlor 2&3)

- Manoj Monga  
- Sutchin Patel  
- Brian Matlaga  
- Koon Ho Rha
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    Cervando Ortiz-Vanderdys

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    RiccardoAutorino

35  “5-MM PORT” LAPAROSCOPIC NEPHRECTOMY: IMPROVED COSMESIS WITHOUT TECHNICAL RESTRICTIONS  
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37  3D COMPUTER-GUIDED TRUS PROSTATE BIOPSY: PILOT STUDY  
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ABSTRACT 1

MECHANICAL PROPERTY CHARACTERIZATION OF PROSTATE CANCER USING A PALPATION DEVICE IN AN EX VIVO INDENTATION EXPERIMENT: FEASIBILITY EVALUATION ADJUNCT TO DIGITAL RECTAL EXAMINATION

Enrique Ian S. Lorenzo¹, Bummo Ahn², Cheol Kyu Oh¹, Woong Kyu Han¹, Jung Kim² and Koon Ho Rha¹

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Introduction: The aims of this study were to measure the mechanical property of prostate tissues using the palpation device we developed and to determine whether the measurable differences in mechanical property exist between cancer and non-cancer tissues in an ex vivo experiment.

Methods: Using the palpation device we developed, tissue elasticity was measured in both benign and malignant tissues of the prostate. A total of 552 sites from 46 prostate specimens taken from radical prostatectomy underwent an indentation experiment with the palpation device, and the elastic modulus (Young’s modulus) of tissue was estimated. We developed a palpating device mainly composed of a micromotor, linear position sensor, a force transducer, and a hemisphere tip and cylindrical body probe (Figure 1). It underwent motion calibration as well as performance validation.

Results: The mean elastic moduli of the regions containing cancer and non-cancer tissues were 24.1 ±14.5 kPa and 17.0 ± 9.0 kPa, respectively. In non-cancer regions, the prostate was separated into 5 parts according to the post hoc test for comparing the elastic modulus between the 2 groups: part 1, the lateral apex (LA); part 2, the medial apex (MA); part 3, the lateral mid (LM); part 4, the lateral base (LB); and part 5, the medial mid (MM) and medial base (MB). In regions containing cancer tissue, the prostate was also separated into 5 parts: part 1, LA and MA; part 2, LM; part 3, LB; part 4, MB; and part 5, MM. Elastic modulus was higher in tissues with a Gleason score of 8 than in the other tissues. Elastic modulus was significantly higher in tissues with a tumor volume of over 5 ml than in the other tissues.

Conclusion: Elastic modulus of the tissues can be determined by our palpation device. It has the potential to differentiate malignant and benign kidney and bladder tissues. Further studies are necessary to verify this potential and define its true clinical utility.

Figure 1. Experimental setup of the palpation device
ABSTRACT 2

A NEW ROBOT FOR TRUS PROBE MANIPULATION
Felix Schäfer, Doru Petrisor, Chunwoo Kim, Shadie Badaan, Misop Han, Dan Stoianovici
URobotics Lab, Urology Department, Johns Hopkins University, Baltimore, MD
http://urobotics.urology.jhu.edu/

Introduction: We previously developed a robotic arm (TRUS Robot) with 3 degrees of freedom (DOF) to hold and manipulate a transrectal ultrasound (TRUS) probe. In an ongoing clinical trial, we have been using the TRUS Robot during robot-assisted laparoscopic prostatectomy (RALP) in a tandem-robotic approach (T-RALP) with the goal to provide intraoperative US guidance to better preserve the neurovascular bundles (NVB). The TRUS Robot can track images with a unique reference frame for three-dimensional image reconstruction and it allows remote manipulation of the TRUS probe, eliminating the need for a human assistant. To expand its functionality, we developed the second generation TRUS Robot with improved maneuverability and several novel features.

Methods: A new TRUS driver module was designed and constructed to fit an updated version of the Remote Center of Motion (RCM) module (Figure 1). The main improvement of the second generation TRUS Robot is the 4th axis DOF for probe translation along its axis (Tz), in addition to the three rotary axes about a fulcrum point (Rx, Ry, and Rz). A TRUS probe is mounted with a specially built adapter and can be easily inserted in a predefined position and fixed in place. Rotation about the axis of the probe was updated with an open horseshoe shaped angular guide, allowing an additional space for a needle placement. The robot also is fitted with five piezo-resistive force sensors integrated into the design to measure torque and force applied to the probe.

Results: The prototype was built in our URobotics Laboratory. The robot is compact, yet highly maneuverable. It provides a wide range of motion, allowing the scanning of the whole prostate gland in all directions: 75mm translation along (Tz) and 220° rotation about (Rz) the axis of the TRUS probe. Force sensors measure all interaction forces and torques of the TRUS probe except for the torque about its axis (z-axis).

Conclusion: The updated robot provides improved maneuverability of the TRUS probe. Its compact structure allows its use in conjunction with the daVinci® robot (Intuitive Surgical Inc.) for T-RALP. In addition, its compact structure with an open horseshoe construction over the probe permits manual placement of a needle through the needle guide of the probe for future diagnostic or therapeutic applications. The interaction force measurements by the robot can potentially augment safety in haptic driven applications. Its clinical utility will be investigated in future studies.

Acknowledgement: Partially supported by award R21CA141835 from the National Cancer Institute, the Sidney Kimmel Comprehensive Cancer Center at Johns Hopkins, and Hitachi Medical Systems America. The content is solely the responsibility of the authors and does not necessarily represent the official views of the NCI, JHU, or HMSA.

Figure 1: TRUS Robot with 4 degrees of freedom
ABSTRACT 3

ROBOTIC PARTIAL NEPHRECTOMY: CUMULATIVE SINGLE CENTER EXPERIENCE WITH 175 CONSECUTIVE CASES

Sylvain Forest, Georges-Pascal Haber, Michael A. White, Riccardo Autorino, Rakesh Khanna, Bo Yang, Fatih Altunrende, Robert J. Stein and Jihad H. Kaouk
Glickman Urological and Kidney Institute, Cleveland Clinic

Introduction: The robotic platform has been incorporated into routine usage at several urology centers. We present perioperative outcomes in an observational cohort of patients who underwent Robotic Partial Nephrectomy (RPN) at a single academic institution.

Methods: A prospective study was performed to evaluate operative outcomes following RPN. Salient demographic and radiographic data were obtained. Operative data including estimated blood loss (EBL), operative time, and warm ischemia time (WIT), where applicable, were recorded. Pathology was reviewed and classified according to the AJCC staging system. Patients were followed post-operatively for evidence of immediate and delayed complications. Renal functional outcomes were obtained and estimated creatinine clearance calculated using the Cockgroft Gault formula.

Results: See Table below.

Conclusion: Robotic Partial Nephrectomy offers safe perioperative outcomes with promising short-term functional and oncological outcomes. Prospective, comparative studies to conventional and laparoscopic partial nephrectomy are needed.

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<th>RPN (n=175)</th>
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<td>BMI(Kg/m2)</td>
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<td>Tumor size (cm)</td>
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<td>Solitary kidney (n)</td>
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<td>Preoperative Scr (ng/ml)</td>
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<td>Recurrence-free survival</td>
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ABSTRACTS

ABSTRACT 4

PERCUTANEOUS NEPHROLITHOTOMY: A COMPARISON OF TRACT LENGTH AND PERMITTED ANGLES OF ACCESS BETWEEN THE PRONE AND SUPINE POSITIONS

Nikhil Waingankar, Zhamshid Okhunov, Arthur D. Smith, Zeph Okeke
North Shore-Long Island Jewish Health System, New Hyde Park, NY

Introduction: Percutaneous nephrolithotomy via the supine approach is regaining resurgence as the preferred approach in select groups of patients. Longer tract length has often been cited as one of the many limitations of this approach. The purpose of the study was to evaluate tract lengths, potential angles of access, and kidney mobility between the prone and supine positions.

Methods: Abdominal CT scans were performed in the supine and prone positions in 20 patients. Percutaneous tract lengths were measured for direct and sub-costal punctures in both positions. Potential angles of access were measured and compared in both positions with respect to the sagittal plane, and the maximum permitted angle being marked by bowel, liver, or spleen. Kidney position was measured as the distance between the anterior aspects of the kidney and vertebral body.

Results: For right-sided direct punctures, mean tract lengths were 107.3mm in supine and 86.91mm in prone position. For left-sided direct punctures, mean tract lengths were 105.5mm and 88.91mm, respectively. Mean tract lengths for supine sub-costal punctures were 107.1mm (right) and 109mm (left); the greatest difference in tract length between prone and supine was for sub-costal upper pole access (19.2mm difference on right, 25.5mm on left). All differences were statistically significant between the two positions (p<0.05). Prone position allowed for a greater maximum angle of entry, with a left-sided mean of 104.0 degrees vs. 89.4 degrees in supine (p=0.006), and right-sided means of 99.7 and 87.7 degrees, respectively (p=0.01). Renal location relative to the vertebral bodies was similar for both positions (p=0.4 on left, p=0.25 on right).

Conclusions: Extra long and specialized instruments are needed to accommodate the longer tracts and narrower angles of permitted instrumentation encountered with the supine approach. These tract lengths will be exaggerated even further in an obese patient for whom the supine approach is often advocated due to the greater abdominal wall and subcutaneous fat distance that must be traversed by the tract.
STATUS OF ROBOTIC SURGICAL EDUCATION IN UROLOGY TRAINING PROGRAMS

David Shore, Geoffrey Box, and Ronney Abaza
Ohio State University Medical Center & James Cancer Hospital

Introduction: Robotic surgery continues to gain momentum among urologists. While urologists involved in resident training are incorporating robotics into their practices, the extent of resident training in robotics and their level of preparedness to perform robotic surgery upon graduation are unknown. We surveyed residents from urology training programs across the country to evaluate the extent of robotic surgery training at their institutions and their perceptions regarding adequacy of their training.

Methods: Residents and fellows attending a didactic robotic surgery course designed specifically for trainees were asked to complete questionnaires before and after the course regarding the status of robotic training in their programs and their attitudes toward robotic surgery. Various aspects, including frequency and type of cases performed robotically, amount of resident console time, and the presence of robotic curricula and dry labs were analyzed and compared with trainee perception of the adequacy and quality of the robotic training they receive.

Results: Fifty-two participants from 39 different training programs attended the course, with an 81% response rate to questionnaires. Respondents indicated that an average of 4 robotic surgeries per week were being performed at their institutions, with 95% of programs using robotic surgery to perform prostatectomy, 71% for pyeloplasty, 62% for partial nephrectomy, and 48% for cystectomy. Residents perform entire cases at the console at only 24% of programs, and console time is initiated at an average level of training of PGY 4.1. An official robotic curriculum exists at only 34% of programs and robotic dry lab training at 54%. Only 18% of trainees indicated that they were satisfied with the extent of their robotics education. Only 38% felt that residents graduating from their programs are competent at performing robotic surgery, yet 97% planned on operating robotically upon graduation. Trainees who felt residents graduating from their program are competent in robotic surgery were more likely than those who were not confident in their adequacy of training to have earlier console exposure (mean PGY 3.5 vs. 4.5, p=0.008), completion of entire cases at the console by residents (64% vs. 4%, p=0.004), a greater number of robotic cases per week (mean 7 vs. 3, p=0.003), and a greater number of attending physicians performing robotic surgery (mean 4 vs. 3, p=0.03). The presence of a formal curriculum and dry lab experience were not statistically significantly associated with perceived competence to operate robotically upon graduation.

Conclusion: Robotic surgery education at a sample of U.S. urology residency programs is variable but with overall low rates of trainee satisfaction with and perceived adequacy of current training. Despite this, nearly all trainees responding indicated that they still plan to perform robotic surgery upon graduation. While robotic surgery is being practiced at almost all of the training programs of surveyed residents, the propagation of robotic skills in trainees may be insufficient.
PREDICTORS OF OUTCOMES OF PERCUTANEOUS NEPHROLITHOTOMY

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2 Clinical and Translational Science Institute (CTSI), University of Pittsburgh

Introduction: Percutaneous nephrolithotomy (PCNL) is the treatment of choice in patients with large stone burden or when other modalities of treatment are not successful. The stone-free rates after PCNL have ranged from 70% to 85%. At the same time, the use of second look flexible nephroscopy is assumed to increase stone-free rate. However, the predictors of having residual stones post PCNL have not been studied previously. Our objective was to evaluate the preoperative and perioperative factors associated with residual stones after single-tract PCNL. Our hypothesis was that the use of second look flexible nephroscopy is associated with improved outcome.

Methods: Data were extracted from an institutional review board-approved retrospective review of 230 procedures performed at our institution between January 2000 and December 2008. Single-tract PCNL was performed by two endourologists with similar training and experience. Second look flexible nephroscopy was done in patients who were not stone-free after the initial procedure. Outcome was defined as stone-free status after initial PCNL or second look nephroscopy while overall stone-free status is after subsequent additional procedures. Stone-free status was strictly defined based on complete absence of stones on subsequent radiological imaging. The assessed parameters were age, sex, Body Mass Index (BMI), stone size, number, and location, history of genitourinary anomaly or surgery, staghorn stones, prior surgery for the same stone, access location, and use of specific lithotripters. A sub-analysis was performed in patients with residual stones after the initial procedure to evaluate the role of second look nephroscopy. Univariate and multivariate analyses were performed using Pearson Chi-square, two-tailed t, and Fisher’s Exact tests. All variables were considered statistically significant at p<0.05

Results: Mean age and BMI were 54.15 years and 29.59 kg/m² respectively. Univariate analysis revealed that stone diameter (p<0.0001), complete staghorn stones (p<0.001), and upper pole stones (p<0.0001) were associated with having more residual stones while prior extracorporeal shockwave lithotripsy (p<0.037) and holmium laser use (p<0.01) were associated with improved stone-free status. In a sub-analysis of patients who had residual stones after the initial procedure, second look nephroscopy was associated with improved overall stone-free status (p<0.019) in comparison to patients who did not have a second-look.

Conclusion: Preoperative and perioperative parameters can predict outcome of single-tract PCNL. Second look flexible nephroscopy is associated with improved stone clearance. These results indicate that further studies with larger sample size are needed to construct preoperative prediction models.
POSTOPERATIVE DAY ONE DISCHARGE AFTER ROBOTIC PARTIAL Nephrectomy

Ketul Shah, Ronney Abaza
Ohio State University Medical Center & James Cancer Hospital

Introduction: One potential benefit of minimally-invasive surgery is reduced length of hospitalization, but published lengths of stay after robotic or laparoscopic partial nephrectomy have not been significantly different from those after open surgery at centers of excellence. We target discharge on the first postoperative day (POD) after robotic partial nephrectomy attempting to take advantage of the potentially less morbid procedure and analyzed our early outcomes with this strategy.

Methods: We reviewed all patients undergoing robotic partial nephrectomy by a single surgeon (RA) since instituting a clinical pathway targeting discharge on POD#1. The clinical pathway consisted of preferentially using 4 ports with specimen extraction typically at the periumbilical port site when present and bupivacaine injected at all port sites. Patients ambulate and take clear liquids the night of surgery. Intravenous narcotics are avoided with oral analgesics and ketorolac for pain control. No drain or stent is left in place. The Foley catheter is removed and regular diet started the morning after surgery with discharge the same day when pain is controlled orally and regular diet is tolerated. Target discharge was not modified based upon tumor size, location, or for solitary kidneys. Ability to adhere to the pathway and meet discharge goal was analyzed.

Results: A total of 45 consecutive robotic partial nephrectomy patients were reviewed. Mean patient age was 56yrs (22-82yrs), mean BMI 32kg/m2 (20-45kg/m2), and mean tumor size 2.8cm (0.9-9cm) with one solitary kidney and two patients with 2 partial nephrectomies from the same kidney. Mean OR time was 205min, mean blood loss was 183mL, and warm ischemia time 16.2min (0-28.5min). All patients ambulated the day of surgery, and only one required a single dose of intravenous narcotics. A closed-suction drain was left in 2 patients early in the series who had 1/3 of the kidney excised or more and was removed prior to discharge. Forty-two of 45 patients (93%) were discharged on POD#1. The remaining 3 were discharged on POD#3 due to nonspecific bowel complaints in one, exacerbation of pulmonary disease in another, and bleeding requiring transfusion after excision of a 5cm endophytic, hilar tumor. No other patient required transfusion. Mean length of stay was 1.07 days. One patient was discharged on POD#1 with a catheter due to retention. Only one patient discharged on POD#1 was readmitted at an outside facility for pneumonia on POD#4, and one patient discharged on POD#3 was readmitted on POD#19 and found to have a small urine leak without urinoma on CT scan that resolved with Foley catheter drainage. No others were seen in the emergency room, readmitted, or had an unscheduled clinic visit within 30 days of surgery.

Conclusions: Discharge on POD#1 is feasible in most patients after robotic partial nephrectomy without increased complications and may represent an advantage over open surgery if such a clinical pathway is applied. Readmission rate in our series was low, indicating that longer admissions may not prevent readmission or identify complications earlier when patients meeting discharge criteria go home on POD#1.
ABSTRACT 8

ROBOTIC NEPHRECTOMY AND PARTIAL NEPHRECTOMY: 100 CASES

Ronney Abaza
Ohio State University Medical Center & James Cancer Hospital

Introduction: While robotic prostatectomy has gained acceptance in the urologic community, robotic renal surgery is still an emerging application. We reviewed our initial outcomes of robotic nephrectomy (RN) and partial nephrectomy (RPN).

Methods: Between February 2008 and 2010, a total of 45 patients underwent RN and 55 patients underwent RPN for one or more tumors as performed by a single surgeon (RA). Nephroureterectomy and single-incision procedures were excluded, and outcomes were reviewed.

Results: Mean patient age was 57yrs (19-86yrs), and mean BMI was 32kg/m² (20-54 kg/m²). Two RPN patients had solitary kidneys and four patients had multiple tumors with 2 to 4 tumors in the same kidney. One RPN patient was treated for recurrent tumor three years after cryotherapy. Mean operative time was 196min (181min for RN and 206min for RPN). Operative times ranged from 62-396min in RN with the longest procedure in a patient with vena caval tumor thrombus and ranged from 77-436min in RPN with the longest procedure in the patient with 4 tumors excised. Mean blood loss was 142mL (67mL for RN, 201mL for RPN). Mean tumor size was 2.8cm (1-9.4cm) for RPN and 6.9cm (2.2-18cm) for RN. Thirteen RN patients had T3 tumors (29%), including five with vena caval tumor thrombi 1-4cm in length and two with renal vein thrombi. Mean warm ischemia time for RPN was 11.9min (0-30min). Ninety-three patients (93%) were discharged on day one. Two RPN and one RN patients required transfusion (3%). Malignant pathology was identified in 68% of RPN and 87% of RN. All RN patients had negative margins while one patient who underwent RPN for angiomyolipoma and one who underwent debulking RPN for metastatic TCC had positive margins out of a total of 59 tumors excised (3%). There were no conversions to open or laparoscopic surgery. Two had later negative exploratory laparotomy for suspected bowel injury with no other major complications. One RPN patient had a urine leak but no urinoma and was managed successfully with a Foley catheter for one week. With mean followup of 10.5mos, one solitary recurrence was resected after RN in a patient with T3 disease, two died of metastatic disease, and one has stable metastases on medical therapy.

Conclusion: Results of RN and RPN appear favorable even for more complex tumors. The role of robotic renal surgery remains to be defined, but robotics may be of benefit over standard laparoscopic surgery particularly for more challenging cases.
SIMPLE PERCUTANEOUS URETERAL STENTING TECHNIQUE FOR PEDIATRIC ROBOTIC PYELOPLASTY

Jennifer L. Young and Antoine E. Khoury
University of California, Irvine

Introduction: Stent placement in laparoscopic or robotic pyeloplasty can be a technically challenging aspect of the procedure. Here we describe a simple technique for percutaneous antegrade, ureteral stenting in pediatric robotic pyeloplasty.

Methods: The Foley catheter is secured to the patient’s thigh and connected to a three-way connector, which is connected to a drainage bag to gravity and a liter bag of sterile water injected with an ampule of methylene blue. The patient is placed in modified lateral decubitus position with all pressure points padded. Robotic-assisted laparoscopic pyeloplasty is performed. Once ready for stent placement, the bladder is filled with blue-colored sterile water. An Introducer Safety™ 14 gauge angiocatheter (Braun, Melsungan, Germany, reference number 4252594-2, Figure 1) is placed percutaneously through the abdominal wall at a point directly overlying the anastomosis. The needle is withdrawn for 2 mm to shield it but left in the angiocatheter to facilitate directing the tip of the angiocatheter inside the renal pelvis and down the ureter. A 0.035 hydrophilic wire is placed through the angiocatheter, down the renal pelvis and ureter into the bladder. A 4.7 or 6 French ureteral stent is placed over the wire and passed through the renal pelvis, confirming the stent placement in the bladder. The wire is removed and the proximal stent coil dunked into the renal pelvis. The bladder is drained. The renal pelvis is closed and the pyeloplasty completed.

Results: Five patients have undergone successful stent placement with this technique. No cystoscopy or fluoroscopy was necessary. The technique is practical, efficient and adds no more than three minutes to the robotic or laparoscopic pyeloplasty.

Conclusion: Percutaneous placement of a ureteral stent via a 14 gauge angiocatheter is feasible. This novel technique avoids the need for cystoscopy or radiation exposure.

Figure 1: 14 gauge angiocatheter for percuteneous stent introduction
ABSTRACT 10

RECURRENCE RATES FOLLOWING PERCUTANEOUS AND LAPAROSCOPIC RENAL CRYOABLATION (RC) OF SMALL RENAL MASSES (SRM): DOES THE APPROACH MAKE A DIFFERENCE?

Kurt H Strom1, Sean P Stroup2, Reza Mehrazin3, John B Malcolm4, Xiao Gu1, James L'Esperance5, Robert Wake3, Robert Gold3, Michael Fabrizio4, Ithaar Derweesh6, Carson Wong1

1University of Oklahoma Health Sciences Center; 2University of California, San Diego Naval Medical Center; 3University of Tennessee Health Science Center; 4Eastern Virginia University; 5San Diego Naval Medical Center; 6University of California, San Diego

Introduction: As the incidence of radiologic detection of renal masses increases, poor surgical candidates are offered either percutaneous renal cryoablation (PRC) or transperitoneal laparoscopic renal cryoablation (TLRC). This multicenter experience compares PRC and TLRC.

Methods: Between 09/1998 and 02/2009, retrospective review of our PRC and TLRC experience was performed. Patients with a minimum 12 month follow-up were included for analysis. Post treatment surveillance consisted of laboratory studies and imaging at regular intervals. Treatment failure was considered if persistent mass enhancement or interval tumor growth was evident on radiography. Repeat biopsy and retreatment were recommended in the event of recurrence.

Results: 61 (67.2% male; 32.8% female) patients underwent PRC, having a mean body mass index (BMI) of 30.2±6.4kg/m2. 81 (58.0% male; 42.0% female) patients underwent TLRC, having a mean BMI of 29.8±6.6kg/m2 (p=0.770). The average patient age was 69.1±11.5 (PRC) and 65.7±10.0 (TLRC) years (p=0.062). Comorbidities in the PRC and TLRC cohorts were: 21.3±41.3% vs. 33.8±47.6% diabetes mellitus (p=0.106), 72.1±45.2% vs. 78.8±41.2% hypertension (p=0.366) and 42.6±49.9% vs. 58.8±49.5% smoking history (p=0.058), respectively. Mean tumor size was 2.7±1.1 (PRC) and 2.5±0.8 (TLRC) cm (p=0.153). 76.4±42.8% (PRC) and 60.3±49.3% (TLRC) renal masses (p=0.052) were biopsy-confirmed renal cell carcinoma (RCC). The mean follow-up was 31.0±14.1 (PRC) and 39.8±22.6 (TLRC) months (p=0.009), with local tumor recurrence noted in 15.0±36.0% (PRC) and 5.0±21.9% (TLRC) of kidneys (p=0.044), respectively. In the PRC cohort, disease-free survival (DFS) and overall survival (OS) were 93.3±25.2% and 91.7±27.9%, with 4 patients having evidence of disease at last follow-up. DFS and OS was 92.5±26.5% and 93.8±24.4% in the TLRC group, with 6 patients having evidence of disease at last follow-up. DFS (p=0.851) and OS (p=0.639) were similar.

Conclusion: In this multicenter study of well matched PRC and TLRC cohorts, PRC had higher primary treatment failure rates than TLRC. However, a greater percentage undergoing PRC had biopsy-confirmed RCC. DFS and OS survival were similar in both groups. Additional follow-up is required to determine if the approach, either PRC or TLRC, truly affects treatment outcomes.
ABSTRACTS

ABSTRACT 11

PURE NOTES TRANSVAGINAL NEPHRECTOMY

Jihad H Kaouk, Georges-Pascal Haber, Raj K Goel, Sebastien Crouzet, Farzeen Firoozi,
Howard B Goldman, and Wesley M. White

Glickman Urological and Kidney Institute, Cleveland Clinic

Introduction: Natural orifice surgery represents a fundamental change in the intellectual and physical approach to the surgical management of urologic disease. The collective experience with natural orifice surgery in animal experiments, coupled with successful natural orifice translumenal endoscopic surgery (NOTES) diagnostic procedures in humans has generated considerable enthusiasm. We present the first case of pure NOTES transvaginal nephrectomy.

Methods: An IRB-approved study was performed to evaluate the feasibility and safety of NOTES transvaginal nephrectomy. Operative candidates included females with a non-functioning kidney and a compelling indication for removal. A 3cm posterior colpotomy was made and the peritoneal cavity accessed. Standard and articulating instruments were employed to perform pelvic adhesiolysis, reflect the colon, and expose the renal hilum. An endovascular stapler was deployed transvaginally to divide the renal artery and vein. The upper pole attachments were divided using a 65cm articulating monopolar hook. The kidney was entrapped in a laparoscopic retrieval bag and removed.

Results: NOTES transvaginal nephrectomy was successfully completed. The patient was 58 years old with a BMI of 32.3 kg/m$^2$. Operative time was 420 minutes, EBL was 50mL, and the mean length of hospitalization was 19 hours. Visual analog pain scale score at discharge was 0/10. No intraoperative or postoperative complications occurred. The surgery was completed exclusively from the vagina without additional instrumentation from the abdomen.

Conclusions: NOTES transvaginal nephrectomy is technically feasible. Future study is needed to better define patient selection criteria and indications for NOTES transvaginal urologic surgery.
ABSTRACT 12

BASELINE SEXUAL HEALTH INVENTORY FOR MEN (SHIM) PREDICTIVE OF ERECTILE FUNCTION FOLLOWING ROBOT-ASSISTED LAPAROSCOPIC PROSTATECTOMY (RALP)

Kurt H Strom, Massimiliano Spaliviero, Xiao Gu, Carson Wong
University of Oklahoma Health Sciences Center

Introduction: Preoperative erectile function and age are powerful predictors of erectile function following surgical treatment of clinically localized prostate cancer. We determine if baseline SHIM scores are predictive of erectile function following nerve-sparing RALP.

Methods: Consecutive patients who underwent transperitoneal RALP by a single surgeon (CW) were reviewed. Using an anterior approach, a bladder neck sparing procedure was preferentially performed. Bilateral/unilateral nerve sparing prostatectomy was performed when appropriate. Penile rehabilitation [phosphodiesterase-5 (PDE-5) inhibitor and vacuum erection device (VED)] was offered to all patients. SHIM scores were obtained at baseline, 6 weeks and 3, 6, 9, 12, 15, 18, 21 and 24 months post-surgery.

Results: 161 consecutive patients were identified, of whom 148 (91.9%) underwent nerve sparing prostatectomy [133 (82.6%) bilateral; 15 (9.3%) unilateral] and 13 (8.1%) did not (p<0.05). Of those undergoing nerve sparing prostatectomy, 112/148 (75.7%) had penile rehabilitation. The mean baseline SHIM of patients with nerve sparing prostatectomy and penile rehabilitation was 16.5 ± 8.0. 41/112 (36.6%) patients had baseline SHIM < 15 (mean 7.4 ± 4.5) and 71/112 (63.4%) patients had baseline SHIM ≥ 15 (mean 22.0 ± 3.2). In comparing these patient groups, SHIM postoperatively were similar until the 6 month follow-up interval, where the SHIM diverged significantly. Those with a preoperative SHIM ≥ 15 showed significantly greater improvement in their postoperative SHIM versus those with a preoperative SHIM < 15.

Conclusion: Preoperative SHIM scores are a useful tool in predicting postoperative SHIM scores in men undergoing RALP with unilateral and bilateral nerve sparing plus penile rehabilitation therapy.
ABSTRACT 13

DIFFERENCES IN GRIP FORCES AMONG VARIOUS ROBOTIC INSTRUMENTS AND DA VINCI SURGICAL PLATFORMS

Phillip Mucksavage, Donald Pick, David Kerbl, Jacqueline Ho, Jason Lee, Michael Louie, Elspeth McDougall

Dept. of Urology, University of California- Irvine

Introduction: Over 80% of all radical prostatectomies are estimated to be performed via the robotic approach using the da Vinci surgical platform in the next year. Since the current version of the robot does not have haptic feedback systems, the surgeon must rely on visual clues to guide the amount of force or tension placed on the tissue during dissection. The actual grip forces exerted by the robotic instruments during the operation have not been examined. We directly measured robotic grip forces of instruments commonly used during urologic surgery using the three commercially available Da Vinci robotic surgical platforms.

Methods: Robotic instruments were tested in the da Vinci S, SI and Standard systems. A load cell was placed in a housing unit that allowed for measurement of the grip forces applied by the tip of each robotic instrument. Each instrument was tested in triplicate and all data were analyzed using Student’s t tests or analysis of variance, where appropriate.

Results: A range of grip forces were seen among the various robotic instruments tested, as summarized in Table 1. The instrument with the lowest grip force was the grasping retractor, while the Hemolock clip applier exhibited the highest grip force. There were no statistically significant differences in grip forces between the SI and S; however, most instruments had significantly larger grip forces in the Standard when compared to the SI or S systems.

Conclusion: Different grip forces were seen among the various robotic instruments commonly used during urologic surgery. Difference in grip force also was seen when comparing the S and SI systems to the Standard system. These differences in grip forces may have implication in instrument selection during the delicate portions of robotic surgery.

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Standard</th>
<th>S</th>
<th>SI</th>
<th>p Value</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>GRASPING RETRACTOR</td>
<td></td>
<td>2.61(0.102)</td>
<td>2.39(0.116)</td>
<td>p = 0.200*</td>
<td>Low</td>
</tr>
<tr>
<td>in E/Ft (2 D)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PK DISSECTING FORCEPS</td>
<td>4.24(0.096)</td>
<td>3.48(0.082)</td>
<td>3.62 (0.42)</td>
<td>p = 0.012**</td>
<td>Low</td>
</tr>
<tr>
<td>in E/Ft (2 D)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CADIERE FORCEPS</td>
<td>5.02(3.24)</td>
<td>4.42 (0.22)</td>
<td>4.26 (0.12)</td>
<td>p = 0.008**</td>
<td>Low</td>
</tr>
<tr>
<td>in E/Ft (3 D)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MARYLAND BIPOLAR FORCEPS</td>
<td>5.52(0.14)</td>
<td>5.89(0.14)</td>
<td>4.91(0.34)</td>
<td>p = 0.038**</td>
<td>Low</td>
</tr>
<tr>
<td>in E/Ft (5 D)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ROUND TIP SCISSORS</td>
<td>6.35(0.60)</td>
<td>5.34(1.47)</td>
<td></td>
<td>p = 0.563*</td>
<td>Low</td>
</tr>
<tr>
<td>in E/Ft (3 D)</td>
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<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>MONOPOLAR CURVED SCISSORS</td>
<td>7.64(0.22)</td>
<td>6.55(0.32)</td>
<td>6.55(0.10)</td>
<td>p = 0.012**</td>
<td>Low</td>
</tr>
<tr>
<td>in E/Ft (3 D)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PROGRASP FORCEPS</td>
<td>10.87(0.37)</td>
<td>11.09(0.32)</td>
<td></td>
<td>p = 0.412*</td>
<td>Medium</td>
</tr>
<tr>
<td>in E/Ft (3 D)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LARGE NEEDLE DRIVER</td>
<td>11.67(0.57)</td>
<td>11.20(0.67)</td>
<td>11.67(0.30)</td>
<td>p = 0.003**</td>
<td>Medium</td>
</tr>
<tr>
<td>in E/Ft (2 D)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SUTURECUT NEEDLE DRIVER</td>
<td>12.53(0.69)</td>
<td>12.59(0.16)</td>
<td></td>
<td>p = 0.871*</td>
<td>Medium</td>
</tr>
<tr>
<td>in E/Ft (2 D)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HEMOLOCK CLIP APPLIER</td>
<td>23.72(1.02)</td>
<td>25.21(0.56)</td>
<td>24.00(1.21)</td>
<td>p = 0.215**</td>
<td>High</td>
</tr>
</tbody>
</table>

* determined by Student T-Test, ** determined by One-Way Anova. A p value less than 0.05 was considered significant. S.D = standard deviation.
ABSTRACT 14

PRELIMINARY INVESTIGATION OF DYNA CT-GUIDED PERCUTANEOUS RADIO-FREQUENCY ABLATION OF RENAL TUMORS

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Introduction: CT-guided, percutaneous radiofrequency ablation (CT-RFA) is currently being used at the University of Miami for the treatment of solid enhancing renal masses. The treatment endpoint is determined when temperature at the tumor periphery, measured by fiber-optic thermal sensors, reaches >60 °C. Traditional CT-RFA requires manual adjustments to needle trajectory and serial scanning inside the CT gantry or “CT-Fluro” with significantly higher radiation exposure. The Seimens Biplanar Artis Zee system with DynaCT software (Siemens Medical, Germany) is a “C-Arm” based 4 panel scanner which provides cross sectional CT quality images while offering the advantage of improved workspace. RF needle probe and thermal sensors can be performed under fluroscopic guidance, thus reducing the amount of time and radiation exposure required for insertion. Volumetric scans in conjunction with the dynaCT software allows for manipulation of the axial, sagittal, and coronal images, which allows full visualization of the entire probe length. This gives the physician optimal visibility for RFA probe placement. The purpose of this preliminary investigation is to determine the efficacy of CT-guided RFA of renal masses using the Siemens Artis Zee Biplanar system with Dyna-CT software.

Methods: Six CT-guided percutaneous RFA ablations on renal tumors were performed with guidance from the DynaCT Artis Zee system. Scans were initially taken to ensure adequate placement of the patient and visualization of the renal mass. Up to two RFA probes and four fiber-optic temperature sensors were inserted into the target site using bony landmarks, fluoroscopy, and CT image manipulation. Additional scans were taken during and post-ablation. All procedures were performed under general anesthesia.

Results: For each patient, Needle placement and precision of tract angle was observed. As this is a new application treatment times were not quantified due to the learning curve. Target temperatures >60°C were reached for each targeted tumor. 5 of 6 tumors (all Renal cell cancer) had > 1 month follow-up CT scans demonstrating no enhancement > 20 HU.

Conclusion: The Artis Zee Biplanar system has the potential to allow for faster and more accurate CT-RFA procedures for small renal tumors. We postulate that with further experience treatment times and radiation exposure will be reduced.

Figure 1: The physician uses the CT-fluro for needles guidance (left), which is then reviewed using the axial, sagittal, and coronal CT images (right)
**ABSTRACT 15**

**IN VITRO EVALUATION OF POWER EFFECT ON 532 nm LASER TISSUE VAPORIZATION**

Hyun Wook Kang, Steven Yihlih Peng, Douglas Stinson  
*American Medical Systems, Inc., San Jose, CA*

**Introduction:** Photoselective vaporization of the prostate (PVP) has been developed for effective treatment of obstructive benign prostatic hyperplasia. To maximize tissue vaporization and to reduce procedure time for large prostate gland, identifying the optimal power level for PVP is still necessary. We investigated the effect of various power levels from 120 to 200W on *in vitro* bovine prostate vaporization using a custom-made 532 nm lithium triborate (LBO) laser system.

**Methods:** PVP was performed on 114 bovine prostatic tissue specimens. A custom-made GreenLight 532 nm prototype laser was employed to provide various power levels from 120 to 200W. The laser light was delivered through a newly designed 750µm core-diameter side-firing prototype fiber. Vaporization was conducted on each specimen under saline environment, utilizing an automatic ablation scanner. Tissue vaporization efficiency was evaluated in terms of power (P; 120~200W), treatment speed of fiber (TS; 2~8 mm/s), and working distance between fiber and tissue surface (WD; 1~5 mm). Coagulation depth was also estimated macroscopically and histologically (H&E) at various Ps. Statistical analyses were performed with two-sample t-test; *p*-value of <0.05 was considered significant.

**Results:** Regardless of TS, the 532 nm prototype laser vaporized more tissue as P increased. However, both 180 and 200W yielded comparable vaporized volume (104.3±24.7 vs. 104.1±23.9 mm³ at TS=4 mm/s and WD=2 mm; *p*=0.99); thus, 180W was identified as the optimal power to maximize tissue vaporization, by removing tissue up to 80% faster than 120W (41.7±9.9 vs. 23.2±3.4 mm³/s at TS=4 mm/s and WD=2 mm; *p*<0.005). For both 120 and 180W, tissue vaporization was maximized at TS=4 mm/s and vaporized equally efficiently at up to 3 mm WD (104.5±16.7 mm³ for WD=1 mm vs. 93.4±7.4 mm³ for WD=3 mm at 180W; *p*=0.33). At the slowest TS of 2 mm/s, the mean thickness of coagulation zone for 180W was 20% thicker than that for 120W (1.31±0.17 vs. 1.09±0.16 mm; *p*<0.005) but was still thin comparable to previous findings (1~2 mm).

**Conclusion:** In an *in vitro* model, the 532 nm LBO laser demonstrated that 180W was the optimal power to maximize tissue vaporization efficiency with enhanced coagulation characteristics.

![Figure 1: Vaporized volume as function of power at various treatment speeds](image1.png)  
![Figure 2: Vaporized tissue volume as function of working distance](image2.png)  
![Figure 3: Histological image of bovine prostate treated at 180W (2X)](image3.png)
SAFETY OF WIRELESS FLEXIBLE URETEROSCOPY IN THE TREATMENT OF RENAL CALCULI

Sutchin R Patel, Ian McLaren, Stephen Y Nakada
Department of Urology, University of Wisconsin School of Medicine and Public Health, Madison WI

INTRODUCTION: Given the recent technologic advances in the newer generation of flexible ureteroscopes, the purpose of our study was to assess the safety of wireless ureteroscopy and lithotripsy of renal calculi.

METHODS: Medical records for patients undergoing ureteroscopy by a single surgeon from December 2006 to December 2009 were reviewed retrospectively. Inclusion criteria for our study included all adult patients that underwent wireless flexible ureteroscopy for the treatment of renal calculi and had one month follow-up data.

RESULTS: Of the 568 patients that underwent ureteroscopy during this time period, 268 patients met our study inclusion criteria. The mean age of the patients undergoing wireless ureteroscopy was 33 years, with 57% of them female, and a mean body mass index of 33.1 kg/m². Mean stone diameter of the renal calculi treated was 12.0 ±5.9 mm. Fifteen percent of the patients had a ureteral stent in place prior to the procedure and 84% of the patients had a stent placed following ureteroscopy. Twenty percent of the patients required ureteral dilation and 15% of the patients had a ureteral access sheath placed intra-operatively. The overall complication rate was 5.9% (Major = 0.7%, Minor = 5.2%). Complications included: 1 difficult ureteral access, 4 urinary tract infections, 2 patients with urosepsis, 1 patient with urinary retention. Nine patients were seen in the emergency room for stent related discomfort. No patients had ureteral perforation or ureteral avulsion.

CONCLUSIONS: Wireless flexible ureteroscopy is a safe technique for the treatment of renal calculi.
ANCHOR TISSUE RETRIEVAL BAG FOR ROBOT–ASSISTED LAPAROSCOPIC PROSTATECTOMY (RALP)

Kurt H Strom, Massimiliano Spaliviero, Xiao Gu, Carson Wong
University of Oklahoma Health Sciences Center

Introduction: Intracorporeal specimen spillage is a concern during laparoscopic oncologic surgery. The integrity of a specimen retrieval bag can be threatened by puncture, laceration, tearing, and cautery effects. Fascial opening often is increased in order to allow safe delivery of the specimen. We present the specifications of and our rationale for using a novel specimen retrieval bag for RALP.

Methods: The features of the TRS-100SB™ (Anchor Products, Addison, IL, USA) are examined to highlight its applications for use in specimen retrieval during RALP.

Results: The TRS–100 SB™ has a 10 mm introducer that deploys a 5.6 cm diameter and 14 cm length bag that has a capacity of 235 mL. It is constructed of a Rip-Stop nylon polyamide 66 material, with specially formulated polyurethane laminate, having thickness of 0.09 – 0.11 mm and a hydrostatic leak pressure of 4.5 PSI. In tests simulating accidental puncture by a blunt 5 mm laparoscopic instrument, it withstood a mean 25 pounds of axial force projected by the tip of a 5 mm stainless steel probe. In comparison to other laparoscopic specimen retrieval bags, it has the highest puncture strength-to-thickness ratio per mm thickness (260 lbs/mm) (Table). Bag deployment is simple to perform and specimen retrieval does not require excessive fasciotomy length as the bag exits through it without concerns of breakage from tension, compression, and electrocautery effects.

Conclusion: The dimensions, high strength-to-thickness ratio, and ease of deployment of the TRS–100SB™ specimen retrieval bag lessen the risk of tumor spillage and simplify RALP specimen retrieval. It may have applications in the laparoscopic excision of other abdominal and pelvic organs.

Table: Specimen Retrieval Bag Specifications

<table>
<thead>
<tr>
<th>Tissue Retrieval Bag</th>
<th>Puncture Strength (lbs)</th>
<th>Puncture Strength-to-Thickness Ratio (lbs/mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anchor Products Company</td>
<td>25.6</td>
<td>250.1</td>
</tr>
<tr>
<td>Applied Medical Copolymer Pouch</td>
<td>7.8</td>
<td>68.2</td>
</tr>
<tr>
<td>Cook Nylon 56 Laminated Pouch</td>
<td>27.5</td>
<td>135.9</td>
</tr>
<tr>
<td>Ethicon Copolymer Pouch</td>
<td>5.5</td>
<td>53.6</td>
</tr>
<tr>
<td>Tyco Pouch</td>
<td>5.9</td>
<td>57.7</td>
</tr>
</tbody>
</table>
ABSTRACT 18

OUTSTANDING PAPER AWARD

PARTIAL-VOLUME ARTIFACT ON PROSTATE ULTRASOUND IMAGING

Chien Ming Huang, Chunwoo Kim, Doru Petrisor, Doohyun Lee, Misop Han, Dan Stoianovici
URobotics Lab, Urology Department, Johns Hopkins University, Baltimore, MD
http://urobotics.urology.jhu.edu/

Introduction: The TRUS Robot, a robot to manipulate a transrectal ultrasound probe (TRUS), has been developed and used in tandem robot-assisted laparoscopic radical prostatectomy (T-RALP) to better visualize the neurovascular bundles (NVBs) during surgery and to generate 3-D reconstruction images of the prostate and NVBs. The NVBs lie just outside of the prostatic fascia, adjacent to the prostate gland. We examined how the partial-volume effect of TRUS, a common cross-sectional imaging artifact, could influence NVB localization and 3-D reconstruction results.

Methods: During T-RALP, a side-fire TRUS probe was placed as usual along the cranial-caudal axis. It was rotated by the TRUS Robot so that the prostate can be scanned with variable angle coronal-sagittal views. Images were recorded together with positioning information given by the robot. Image-position pairs were then processed for 3-D reconstruction using Amira software (Visage Imaging, CA). The bladder, urethra, prostate, seminal vesicles, NVBs and rectal wall were segmented. TRUS scanning was also simulated by using a simple mockup in a water basin. The mockup was made of a chicken egg with a thin wire wrapped around it, simulating the prostate and NVBs, respectively.

Results: In the reconstruction of the images acquired in surgery, certain portions of the NVB were observed as if penetrating the prostate (Fig.1). This may be explained as a consequence of a partial-volume artifact. The schematic in Figure 2 shows that when the imaging plane is nearly tangential to the prostate, even though a NVB is represented outside the prostate (red dot outside green circle), in the Image Slice the NVB appears within the prostate (red within green). This artifact appears because partial volumes of adjacent structures within the Slice Thickness are collapsed to one Image Slice. This observation was confirmed in mockup experiments. Figure 3 shows the ultrasound image of a wire wrapped around the egg, when the image plane is nearly tangential to the eggshell. The image clearly shows the artifact, in which the wire appears to penetrate the shell. Therefore, while attempting to image NVBs, Doppler activity within the gland should not be immediately dismissed, especially when a partial-volume artifact is suspected. Doppler ultrasound may artificially show parts of NVBs to be located within the prostate.

Conclusion: Partial-volume artifact in TRUS may make structures adjacent to the prostate, such as NVBs, appear within the gland. This is only apparent when the slice of the image plane is nearly tangential to the capsule. The artifact may be avoided by using transverse imaging. Clinicians should be aware of this important artifact in interpreting prostate ultrasound images.

Acknowledgement: Partially supported by award R21CA141835 from the National Cancer Institute, the Sidney Kimmel Comprehensive Cancer Center at Johns Hopkins, and Hitachi Medical Systems America. The content is solely the responsibility of the authors and does not necessarily represent the official views of the NCI, JHU, or HMSA.

![Figure 1](image1.png)  ![Figure 2](image2.png)  ![Figure 3](image3.png)
ROBOTIC LAPAROENDOSCOPIC SINGLE-SITE (R-LESS) RADICAL PROSTATECTOMY

Michael A. White, Georges-Pascal Haber, Riccardo Autorino, Rakesh Khanna, Jihad H. Kaouk
Glickman Urological and Kidney Institute, Cleveland Clinic

Introduction: To further decrease morbidity of standard laparoscopy, newer techniques such as LaparoEndoscopic Single-Site (LESS) surgery currently are being investigated. LESS surgery is challenging technically and requires an experienced laparoscopic surgeon and assistant. To help overcome current limitations we have introduced the da Vinci surgical system to LESS and report our experience with robotic laparoendoscopic single-site (R-LESS) radical prostatectomy.

Methods: A retrospective review of R-LESS radical prostatectomy was performed. Salient demographic and operative data were obtained. End-points including age, bodymass index (BMI), operative time, estimated blood loss (EBL), complications, conversion, and length of stay (LOS) were examined. Single port access was achieved via a commercially available multi-channel port. The da Vinci-S® surgical platform using pediatric and standard instruments was used.

Results: Between May 2008 and February 2010, a total of 17 R-LESS radical prostatectomies were performed (9 with and 8 without pelvic lymph node dissections).

<table>
<thead>
<tr>
<th>Radical Prostatectomy (n=17)</th>
<th>Age (Years)</th>
<th>BMI (Kg/m2)</th>
<th>Operative Time (minutes)</th>
<th>EBL (ml)</th>
<th>LOS (days)</th>
<th>Adverse Events</th>
<th>Conversion to traditional robotic</th>
<th>Positive Margin Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>61 (54-73)</td>
<td>26</td>
<td>211</td>
<td>187</td>
<td>3.5</td>
<td>0</td>
<td>1</td>
<td>3/17</td>
<td>17.6%</td>
</tr>
</tbody>
</table>

One procedure had to be converted to standard robotic assisted radical prostatectomy due to instrument clashing and gas leakage from the single port. Additionally, two cases required the addition of one extra port to assist with retraction. Three focal positive margins were encountered, with two occurring during the first three cases. Pathology revealed a Gleason score of 3+3 in 3 patients, 3+4 in 9, 4+3 in three, and 4+4 in two. TNM staging revealed T2 disease in 14/17 and T3 in three patients. There have been no biochemical recurrences and at 3 months follow-up, no patient has been using more than one pad for urinary continence.

Conclusion: By introducing the da Vinci robotic system to LESS radical prostatectomy we hope to further diminish the impediments that limit this minimally invasive technique. Prospective studies are needed, but preliminary results are encouraging.
ABSTRACT 20

MODELING OF LASER-TISSUE INTERACTION FOR REAL TIME SURGICAL SIMULATION

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Introduction: Laser-tissue interaction is a multi-physics phenomenon not yet mathematically describable or computationally predictable. It is a challenge to model the laser-tissue interaction for real time laser benign prostatic hyperplasia (BPH) simulation, which requires the laser-tissue interaction model to be computationally efficient and accurate. Under the consideration and enforcement of the first law of thermodynamics and treating the laser-tissue interaction as a gray-box, utilizing the sensitivity analysis of some key parameters that will affect the laser intensity on the tissue surface with respect to the tissue vaporization rate, a phenomenological model of laser-tissue interaction was developed. The developed laser-tissue interaction model has been implemented for a laser BPH simulator and achieved real time performance (more than 30 frames per second). The model agrees well with the available experimental data.

Methods: We treated the laser-tissue interaction as gray-box, and chose as inputs the operating power, sweep speed, and working distance for the laser beam. The output of the model was chosen as the tissue vaporization rate. From the physical phenomenon of laser-tissue interaction, we have the following assumptions: a) at any given time, the tissue vaporization rate is limited by the operating power; b) there is a threshold limit for the linear dependence between the laser intensity and the tissue vaporization rate (volume per time); c) beyond the threshold limit, the vaporization rate is directly correlated to the power; and d) below the threshold limit, the vaporization rate is depend linearly on the intensity. Using these assumptions and with the insufficient data available from the literature, we are able to construct a laser-tissue interaction model that is suitable for the real time surgical simulation.

Results: The experimental data available in the literature are insufficient to construct a phenomenological model of laser-tissue interaction. By using the gray-box approach we are able to construct a laser-tissue interaction model based upon the limited experimental data available in HW Kang, et al., Laser Vaporization of Bovine Prostate: A Quantitative Comparison of Potassium-Titanyl-Phosphate and Lithium Triborate Laser (J Urol 2008; 180:2675-2680). Using the data for the 80W setting of the fiber for the modeling, we were able to predict the behavior of a 120W setting for the fiber (see figure).

Conclusion: The gray-box approach to model the laser-tissue interaction based upon insufficient experimental data provides a feasible approach to model the behavior of laser-tissue interaction.
ABSTRACT 21

FIVE YEAR SINGLE INSTITUTIONAL EXPERIENCE WITH PERCUTANEOURS RENAL CRYOABLATION

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Introduction: Despite excellent short-term results, questions remain regarding the long-term efficacy of renal cryoablation. The purpose of our study was to review the efficacy and complication rates for percutaneous cryoablation for small renal tumors.

Methods: One hundred consecutive percutaneous renal cryoablation procedures were performed in 95 patients between 2003 and 2010 at our institution. Patient medical records and imaging studies were reviewed from this time period. Information extracted included: demographic data, tumor size, length of follow-up, presence of residual tumor or local progression, complications, and length of hospital stay. Follow-up imaging was conducted with contrast enhanced CT or MRI.

Results: The mean patient age was 66 years. Mean tumor size was 2.3cm ± 0.78. The mean follow-up was 18.8 months ± 0.78 (range 3-64.9 months), with a subset of 28 patients with > 2 years follow-up and 50 patients with > 1 year follow-up. Residual tumor was noted on imaging <6 months after treatment in 7 patients (7.1%). All of these patients received repeat treatment with no recurrence noted on follow-up imaging. One patient developed local tumor progression > 6 months following treatment. The mean length of hospital stay was 1 day ±0.46 (range 1-4 days). There were no major complications. Minor complications (7.1%) included 5 perinephric hematomas, 1 body wall paresthesia, and 1 small pneumothorax that did not require a chest tube.

Conclusions: Percutaneous renal cryoablation is a safe and effective treatment for small renal tumors. A larger number of patients with 5-year follow-up is needed to better assess its long-term efficacy.
THE USE OF ELECTROSPUN POLY CAPROLACTONE SCAFFOLDS FOR BLADDER AND URETHRAL SUBSTITUTION IN A RABBIT MODEL

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Introduction: Complications from donor tissue site harvest are well known in bladder augmentation and urethral reconstruction. Here we determine the feasibility of using electrospun poly caprolactone (PCL) scaffolds for urethral and bladder substitution in a rabbit model.

Methods: Eight rabbits underwent either bladder or urethral substitution with PCL grafts (bladder group-4; urethra group-4). Cystoscopy, and cystourethrogram were done prior to graft placement to confirm normal urethral and bladder anatomy. A 5x5cm excised patch segment of bladder in the bladder group, and a 3cm long patch segment of pendulous urethra in the urethra group were replaced with PCL graft. The animals were survived for 3 or 9 months and euthanized after evaluation with cystoscopy and cystourethrogram. The bladder and urethral grafts then were harvested and underwent histopathological evaluation.

Results: One rabbit died in the bladder group 8 days after the procedure due to bladder perforation. All the other rabbits in the bladder group (n=3) were harvested at 3 months and showed graft contracture and stone formation. There was no epithelialization of the graft on histology, and scaffold material was visible as well as an inflammatory multinucleated giant cell reaction. In the urethra group of four rabbits, two were harvested at 3 months and two at 9 months. There was no stricture formation at the graft site in any of the urethral group rabbits. Calcification, false passage, and focal scarring were seen in one rabbit in both the 3 and 9 month urethral groups; two other rabbits had normal findings. Histology also showed visible scaffold material and multinucleated giant cell cells.

Conclusion: In the rabbit, electrospun PCL grafts for bladder and urethral replacement results in an unsatisfactory outcome due to stone formation, graft contraction, and scarring.
OUTCOMES OF ROBOTIC PARTIAL NEPHRECTOMY IN OBESE PATIENTS

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Introduction: Recent studies have shown that laparoscopic surgery is safe in the obese patient and may in fact provide greater benefits compared to the non-obese patient. With the development of robotic surgery, and the resultant improved visibility, ergonomics and ease of suturing, more urologists are attempting minimally invasive nephron-sparing surgery. This has led to an annual rise in the number of robotic partial nephrectomies being performed. The objective of the current study was to evaluate perioperative outcomes in patients undergoing robotic partial nephrectomy (RPN) stratified according to body mass index (BMI).

Methods: A retrospective study was performed to evaluate comparative outcomes between obese and non-obese patients undergoing RPN. Obesity was defined as a BMI ≥ 30 kg/m². Statistical analysis was performed using the Mann-Whitney test for continuous data and Fisher exact test for categorical values. A p < 0.05 was considered statistically significant.

Results: A total of 126 cases of RPN from June 2006 to November 2009 were identified. Of those, 50 were performed for a BMI > 30 (mean BMI = 36.3) and the remainder (N=76) for a BMI < 30 (mean BMI = 26.1). There was no statistically significant change in postoperative parameters including operative time, estimated blood loss, warm ischemia time, length of stay, and percent change in glomerular filtration rate (GFR) defined as the percent change between preoperative and postoperative GFR. Furthermore, there was no statistically significant difference in the incidence of perioperative complications or transfusion requirements (Table 1).

Conclusion: RPN is safe in obese patients with no statistically significant differences in perioperative outcomes compared to non-obese patients.

Table 1. Comparative analysis

<table>
<thead>
<tr>
<th>Parameter</th>
<th>BMI &lt; 30 (N=76)</th>
<th>BMI &gt; 30 (N=50)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean Age (years)</td>
<td>63.5</td>
<td>59.8</td>
<td>0.02</td>
</tr>
<tr>
<td>Mean Tumor size (cm)</td>
<td>2.76</td>
<td>3.45</td>
<td>0.06</td>
</tr>
<tr>
<td>Operative time (minutes)</td>
<td>204.5</td>
<td>209.5</td>
<td>0.26</td>
</tr>
<tr>
<td>Estimated Blood Loss (ml)</td>
<td>311</td>
<td>350</td>
<td>0.69</td>
</tr>
<tr>
<td>Warm Ischemia Time (minutes)</td>
<td>18.1</td>
<td>19.4</td>
<td>0.66</td>
</tr>
<tr>
<td>Length of stay (days)</td>
<td>4.1</td>
<td>4.3</td>
<td>0.31</td>
</tr>
<tr>
<td>% Change in GFR</td>
<td>-8.96</td>
<td>-9.82</td>
<td>0.67</td>
</tr>
<tr>
<td>Conversion</td>
<td>4 (3 to laparoscopy, 1 to open)</td>
<td>1 (conversion to open)</td>
<td>ns</td>
</tr>
<tr>
<td>Transfusion</td>
<td>11</td>
<td>8</td>
<td>ns</td>
</tr>
<tr>
<td>Postoperative Complication</td>
<td>3 (2 Angloembolization, 1 DVT)</td>
<td>5 (1 Angloembolization, 3 DVT, 1 prolonged urine leak)</td>
<td>ns</td>
</tr>
</tbody>
</table>
ABSTRACT 24

A NOVEL APPROACH TO TURBT USING AN ELECTROSURGICAL COLONIC POLYP SNARE

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Introduction: The traditional TURBT presents numerous challenges: Specimen distortion by electrocautery; disruption of bladder tumor (BT) integrity, which may theoretically promote tumor seeding; potential morbidity—including bleeding, perforation, and UO injury. We report on the use of an electrosurgical colonic polyp snare (ECPS) for TURBT.

Methods: Using an ECPS (Olympus, SD-230U-20), measuring 230 cm in length with a wire diameter of 0.48 mm, we performed a series of 6 TURBTs on 4 patients. The BTs ranged from small (<2.5 cm) to large (>5 cm). Two tumors were located at the bladder dome, 1 lateral to the right UO, and 3 along the right lateral wall. The ECPS was lassoed around the stalk of each BT, and with gentle traction with the snare and the use of electrocautery, the BT was severed at its base, with simultaneous fulguration of the tumor base. Subsequent deep resection of the BT base was performed using either a cold cup biopsy forceps or a resectoscope.

Results: Successful transurethral resection of an intact BT specimen was consistently achieved. Our study group included 2 females and 2 males, with a mean age of 51 years (range 24-72). Four specimens demonstrated superficial transitional cell carcinoma (TCC), including 1 low-grade and 3 high-grade tumors, while the remaining 2 specimens - both from the same patient - demonstrated malignant melanoma. The small and medium-sized BTs were extracted from the bladder en-bloc, while the large BT required cleavage with a resectoscope prior to extraction.

Conclusion: The ECPS-TURBT offers enhanced specimen preservation, potentially decreased morbidity, considerable technical ease, decreased operative time, and potentially decreased risk of tumor seeding. This technique is particularly suitable for small to medium-sized BTs with narrow stalks, as well as BTs abutting the UO or dome, where increased morbidity risk favors minimal surgical manipulation.
MRI-GUIDED PROSTATE BIOPSY ROBOT DEVELOPMENT

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http://urobotics.urology.jhu.edu/

Introduction: Prostate biopsies are commonly performed freehand under ultrasound guidance. Due to the manual approach and the limitations of the ultrasound, the procedure has high false-negative rates. We are developing a robotic assistant for performing prostate biopsies guided by magnetic resonance imaging (MRI). Unlike current biopsy technology that targets regions of the gland where cancer is statistically found in men, MRI guidance may also target lesions of image abnormality allowing the biopsy to be personalized for each man.

Methods: The robot is designed in the form of a computer controlled needle guide. The design of the robot is carried out in a virtual patient environment reconstructed from MRI images as shown in the Figure. This shows representative sagittal, coronal, and transverse images taken in a 3 Tesla scanner. The endorectal device orients a needle guide with two degrees of freedom (DOF), Rx and Rz. An MRI compatible biopsy needle (Invivo 11528, Orlando, FL) is passed through the needle guide and the biopsy is collected as usual. We have developed special motors that can safely operate in the MRI without interfering with the functionality of the imager, the PneuStep, which are used for actuation. Under image-guidance, when a prostate target point is selected in the MRI image, the guide is automatically oriented to point to the anatomical correspondent of the selected point.

Results: Designing the robot in a virtual MRI environment allows it to follow a realistic clinical setup. Pro/ENGINEER (PTC, Needham, MA) kinematic analysis shows that the needle may be oriented as needed. The workspace density plot (sagittal plane only shown in the Figure) shows that the needle point can reach any target within the prostate and periprostatic regions. All components are built of fully MRI compatible materials that are not only nonmagnetic but also dielectric such as plastics and ceramics.

Conclusion: A new instrument is under development for precise needle guidance. Combining advanced imaging with precise targeting could potentially improve the outcome of prostate biopsy. In-vivo preclinical experiments are scheduled in the near future to assess the capabilities of the system.

Acknowledgement: The project described was supported by Award Number W81XWH0810221 from the Prostate Cancer Research Program of the Department of Defense. The content is solely the responsibility of the authors and does not necessarily represent the official view of the PCRP or the DOD.

Figure: Endorectal robot for prostate biopsy under MRI guidance: degrees of freedom and workspace density
STANDARD VERSUS SINGLE PORT LAPAROSCOPIC PARTIAL NEPHRECTOMY: COMPARATIVE OUTCOMES

Riccardo Autorino, Georges-Pascal Haber, Michael A. White, Sylvain Forest, Rakesh Khanna, Bo Yang, Fatih Altunrende, Robert J. Stein and Jihad H. Kaouk
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Introduction: To evaluate perioperative outcomes among patients who underwent single port or conventional laparoscopic partial nephrectomy.

Methods: A prospective, observational study was performed to evaluate perioperative outcomes among patients who underwent single port laparoscopic partial nephrectomy (SPLPN). Salient demographic and operative data were obtained. These patients next were compared retrospectively to a contemporary, matched-cohort of patients who underwent conventional LPN (CLPN). End-points including age, BMI, operative time, estimated blood loss (EBL), complications, conversion, and post-operative Visual Analog Pain Scale (VAPS) scores, were examined. Statistical analyses were performed.

Results: Fifteen SPLPN and 15 CLPN patients were evaluated. There were no significant differences between the SPLPN and CLPN cohorts with respect to mean age (66 vs. 59 years, p = 0.149), mean BMI (26.7 vs. 28.0, p = 0.422), mean operative time (196 vs. 245 minutes, p = 0.08), mean EBL (422 vs. 337mL, p = 0.67), and mean length of hospitalization (4.5 vs. 3.5 days, p = 0.494). Mean VAPS score at discharge was significantly less in the SPLPN cohort (0.67/10 vs. 3/10, p = 0.009). One patient in the SPLPN cohort required conversion to standard laparoscopy. Four patients in the SPLPN cohort required post-operative blood transfusions, one of which required angioembolization. Three patients in the CLPN cohort received blood transfusions.

Conclusions: Single port LPN for select small tumors demonstrates equivalent comparative outcomes to conventional LPN with significantly less pain and superior cosmesis in the single port cohort. Prospective, randomized studies are needed to confirm these findings.
ABSTRACT 27

ENDOSCOPIC ASSESSMENT OF THE CANINE PROSTATIC URETHRA AFTER HISTOTRIPSY

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Introduction: Histotripsy is a noninvasive ultrasound (US) technology that induces tissue fractionation by cavitational mechanisms. Application to the canine prostate results in a volume of parenchymal destruction; however, clearance of debris is variable and dependent upon drainage via the urethra. Although, US feedback reliably predicts fractionation of glandular tissue, determination of sufficient urethral treatment is problematic. Our objective was to characterize the endoscopic appearance of the prostatic urethra and assess communication with the targeted volume 2 weeks following histotripsy treatment.

Methods: Histotripsy was delivered transabdominally to 11 dogs using a 750 kHz, piezoelectric therapeutic transducer operated at a pulse repetition frequency of 500 Hz. Dogs were euthanized, antegrade endoscopy performed, and prostates were harvested for histologic processing (2 weeks=10; 72 hrs =1).

Results: In 6 of 11 dogs, endoscopy confirmed presence of a cavity corresponding to the targeted volume (without residual debris) in communication with the urethra. Of the 5 dogs without visual cavity communication, 3 had complete drainage of debris and 2 had retained residual debris on histologic assessment.

Conclusion: Endoscopic confirmation of parenchymal treatment cavity communication with the urethra correlates with complete drainage of debris following histotripsy. This may provide a means to assess adequacy of histotripsy treatment.

Figure: Endoscopic antegrade view of canine prostatic urethra. Note histotripsy treatment cavities on either side of the urethra.
ABSTRACT 28

ROBOTIC RADICAL ANTERIOR PELVIC EXENTERATION: THE UCI EXPERIENCE

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Introduction: Robotic technology may be a tool in reduction of morbidity of radical anterior pelvic exenteration. We report our initial experience with robotic-assisted radical anterior pelvic exenteration in women to evaluate feasibility and outcomes.

Methods: A retrospective review was performed of our bladder cancer database. Twelve women were identified that underwent robotic-assisted radical anterior pelvic exenteration, bilateral pelvic lymphadenectomy, and urinary diversion for clinically localized urothelial carcinoma of the bladder between 2004 and 2008.

Results: Median age was 73.0 +/- 9.6 years and median body mass index was 23.5 +/- 5.0 kg/m². Ten patients underwent ileal conduit diversion, one orthotopic neobladder and one Indiana pouch. Median total operating time was 6.4 +/- 1.5 hours with median console and diversion times of 4.7 +/- 0.9 and 2.5 +/- 1.5 hours respectively. Median blood loss was 275.0 +/- 165.8 ml. Median length of stay was 8.0 +/- 1.6 days. Four patients were T2N0 or less, five T3N0, one T3N1 and two patients T4N0. There was one positive margin. Median number of lymph nodes removed was 23.0 +/- 11.4. Median follow up of 9.0 +/- 6.0 months was available on nine patients. One had a recurrent ureterointestinal stricture, one had colposcopy for vault prolapse, three had metastatic disease.

Conclusions: Robotic-assisted laparoscopic anterior pelvic exenteration appears to be favorable with acceptable operative, pathological, and short term clinical outcomes. In the UCI experience, the robotic anterior exenteration appears to achieve the clinical and oncologic goals for the surgical treatment of bladder cancer.

Figure: Port placement for robotic anterior pelvic exenteration
ROBOTIC PARTIAL NEPHRECTOMY WITHOUT RENAL ISCHEMIA

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Introduction: Minimization of renal arterial occlusion time is a goal of partial nephrectomy in order to avoid ischemic damage of the kidney. We evaluate our early operative outcomes in patients undergoing robotic partial nephrectomy (RPN) without renal hilar clamping. Such “off-clamp” procedures were performed with the kidney perfused fully during scissor excision of tumors and suture reconstruction of the defect without ablation or other regional hypothermia.

Methods: Between September 2009 and March 2010, patients who underwent RPN without renovascular clamping for one or several tumors were reviewed. Indications for off-clamp RPN included solitary kidney, multiple tumors in the same kidney, or electively in patients felt to have amenable tumors.

Results: A total of 17 off-clamp RPN procedures were performed in 14 patients. Four patients had multiple tumors in the same kidney, and one patient had a solitary kidney. Two patients had multiple off-clamp resections from the same kidney, including one patient who had 2 and one who had 3 off-clamp RPNs. Mean patient age was 59 years (range 24-73yrs), and mean BMI was 32 kg/m² (26-43 kg/m²). Mean operative time was 191 min (77-404 min) with a mean blood loss of 277 mL (50-1500 mL). Only one patient with a 1500mL blood loss due to prolonged insufflation device failure after tumor resection required transfusion. Mean tumor size for off-clamp RPN was 2.2cm (0.9-4.9 cm). Mean warm ischemia time for patients who had secondary excision of other tumors with hilar control was 11.2min (7-17min) for tumors 4.6-9.8cm in size. Twelve patients (86%) were discharged on the first postoperative day with only one complication in the patient with prolonged loss of pneumoperitoneum who underwent negative exploratory laparotomy on POD#2 for a suspected bowel injury. All patients had negative margins for all tumors excised with eleven of 17 tumors (65%) found to be malignant. Mean preoperative and postoperative serum creatinine was 0.94 mg/dL (0.69-1.33 mg/dL) and 1.05 mg/dL (0.57-1.32 mg/dL), respectively.

Conclusion: For selected patients and tumors, robotic partial nephrectomy performed without renovascular occlusion is feasible. Further experience is necessary to determine which patients are ideally suited to RPN without ischemia.
ABSTRACT 30

LAPROENDOSCOPIC SINGLE-SITE NEPHRECTOMY: INITIAL CLINICAL EXPERIENCE IN CHILDREN

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UH Case Medical Center, Cleveland Heights, Ohio

INTRODUCTION: Minimally invasive urologic surgery in the pediatric population is becoming more prevalent throughout the urologic community. As a result of the perceived advantages of using a single port, a significant amount of interest has been given recently to advancing the technique of laparoendoscopic single-site surgery (LESS). Herein, we describe our initial experience with single-port nephrectomy (SPN) and, to our knowledge, we report the first use of LESS for bilateral simple nephrectomy in pediatric urology.

METHODS: We reviewed our experience with pediatric patients who had undergone SPN at our institution since August of 2009. Access was obtained by using the Hassan technique to place a 2-cm SILS Port (Covidien Surgical Devices, Norwalk, CT), which contains a gas insufflation channel and three individual cannulae that can readily accommodate laparoscopic instruments up to 12 mm in diameter. Nephrectomy was performed using a standard set of laparoscopic instruments and a rigid 5 mm, 30 degree laparoscope with an end-on light source (Karl Storz, Tuttlingen, Germany). Patient demographics, operative details, histopathology results, and postoperative treatment parameters were collected and recorded.

RESULTS: SPN was performed successfully in three consecutive pediatric patients (one female and two male patients: aged 11, 10 and 13 years, respectively) without placement of additional trocars or conversion to open surgery. The operative time for the unilateral SPN was 188 minutes, while bilateral SPNs required 214 and 300 minutes, respectively. Estimated blood loss for the unilateral and bilateral SPNs was 25, 20, and 30 mL; patients were discharged on postoperative day 1, 3 and 12, respectively. The prolonged hospital stay was secondary to fever and pseudomembranous colitis in a dialysis patient who also required a blood transfusion. At a mean follow-up of 6 weeks (range= 4-8), all patients were functionally at baseline and cosmesis was excellent.

CONCLUSIONS: LESS nephrectomy is a technically demanding, yet feasible, procedure in children. The indications for SPN and other LESS procedures in the pediatric population remain to be defined more clearly. Further studies are necessary in order to elucidate the advantages and limitations of this technique as compared to standard laparoscopy.
ROBOTIZATION OF A URETEROSCOPE FOR AUTOMATIC LITHIASIS VAPORIZATION
Benoit Rosa¹, Pierre Mozer¹², Jérôme Szewczyk¹
¹ ISIR, UPMC/CNRS, Paris, France, ² Department of Urology, Pitié-Salpêtrière Hospital, Paris, France

Introduction: During laser lithotripsy, sweeping the surface of the stone with the laser fiber is required for an effective vaporization of the stone. However, this is made difficult by the poor maneuverability of the ureteroscope. We propose the robotization of a ureteroscope to perform this task semi-automatically, under surgeon control.

Methods: In the proposed system, the operating process remains unchanged for the surgeon; after introduction of the device into the kidney, he locates the lithiasis, inserts the laser fiber in the operating channel, and points towards the lithiasis with it. Hence, when the surgeon pushes the laser pedal, the fiber points towards the lithiasis. The detection of the laser red spot then gives the location of a group of pixels inside the lithiasis. An algorithm using this information was developed for the segmentation of the lithiasis on the video image at 30 frames/s. Once knowing the place of the lithiasis on the image we can plan a path for the laser spot to smoothly sweep the surface of the lithiasis. We developed an actuating system composed of three shape memory alloy wires integrated to the distal tip of the ureteroscope (Figure 1) and commanded through electrical heating. Their length and diameter have been calculated to allow the sweep of a 20 mm wide lithiasis with the laser fiber.

Results: The algorithm accuracy and robustness was validated on 910 images coming from 10 different videos, presenting calculi of four different chemical compositions and sizes varying from 9 to 19 mm. Comparison with the ground truth traced by hand showed that the algorithm is robust and more than 90% effective. The actuators were tested on a 13mm wide lithiasis. We were able to point at every point of the lithiasis surface, using combinations of the three actuators (Figure 2); then, a visual servoing application was developed, showing that the actuated system can be commanded to point at every designated point in its field of view in less than one second.

Conclusion: Semi-automatic laser lithotripsy can be made possible by our system, which would benefit to the surgeon and the patient. Integration of the visual servoing scheme with path planning is the next step to provide a fully operating prototype.
SIMPLE REAL TIME CRYOABLATION ISOThERM DETERMINATION

Cervando Ortiz-Vanderdys  
University of California Irvine

Introduction: The importance of reaching low temperatures below -20°C and -40°C has been established in cryoablation. In studies at our lab we have required quantification of temperature distribution in tissue to demonstrate significance of an intervention. Relating temperature information to resulting pathology has also been required. Isotherm maps simplify this process. The variability of temperature distribution within the ice ball due to freezing probe characteristics, inconsistencies in probe performance, lack of homogeneity in tissue perfusion make the need for real time temperature monitoring desirable. However, none of the vendor supplied solutions met this need.

Methods: A common cycle used for cryoablation is a 10 minute freeze, followed by a 5 minute active thaw, and by a second 10 minute freeze. A series of 10-5-10 minute cycles were performed in vitro using ultrasound gel. Galil Precise equipment was used with one IceRod cryoablation probe, 3 MTS multisensor temperature probes, two TS single sensor probes, and a DeltaTRAK® digital thermometer for reference. The MTS sensors form a 3x4 grid of temperature sensors. Measuring tape references are placed in the gel filled tank. Photographs of the ice ball and the temperature readings are taken at baseline and at the end of every minute during the 10-5-10 cycle for a total of 26 time points for each run. A total of 5 runs are made. The data is interpreted with R-project with the polynom package, and MS Excel. Ice ball measurements are made with the aid of the measuring tool of GIMP software. Lagrange interpolation was used to generate additional points between the actual measurements and extrapolated to one point beyond the measurements for a total of a 7 x 9 resulting matrix. Contour plots were made using the raw data, and with the additional points generated by Lagrange interpolation.

Results: Figure 1 summarizes the result of the mapping of the 5 test cryoablation interventions in vitro. The 95th percentile standard errors of the averaged measurements for the 5 runs are shown by the error bars. We saw no significant difference between the contour maps for the 0°C isotherm calculated from the raw data and the measurements obtained by photograph of the surface of the ice. There was no significant difference between the contour maps for the 0°C isotherm calculated from the data that includes the additional interpolated and extrapolated points after 5 minutes of the first freeze. Significant differences between the calculated isotherms and the actual ice ball were noted for locations outside of the probe grid. A limiting factor for the technique was accurate temperature probe placement.

Conclusion: Lagrange interpolation in conjunction with contour mapping or simple contour mapping offer easy ways to implement a real time (within one minute) visualization of a cryoablation intervention. As implemented here, these isotherm calculations still have the limitations of only monitoring a 2D cross section determined by a 3x4 grid of thermal sensors. Correspondence of maps to actual ice balls improved after using imaging to correct actual temperature sensor location.
PRELIMINARY EVALUATION OF BIOIMPEDANCE BODY COMPOSITION AND BODY MASS INDEX AS PREDICTORS OF ROBOTIC-ASSISTED RADICAL PROSTATECTOMY OUTCOMES

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Introduction: Clinical studies demonstrate a correlation between obesity metrics and oncologic outcomes. To date, studies mostly have relied on body mass index (BMI), which is a crude metric based on patient height and weight. Bioimpedance spectroscopy (BIS) is a relatively new technology that can precisely quantify body composition (BC) in a non-invasive manner. Identifying true body fat percent and correlation to outcome metrics could improve operative planning and patient outcomes following surgery. We compared BIS BC and BMI for concordance of post-surgical outcomes in patients undergoing robotic-assisted radical prostatectomy (RARP).

Methods: Pre-operative BIS BC analysis and BMI determination were conducted on men with biopsy-proven prostate cancer prior to RARP. Height, weight, fat mass (FM), % fat mass (PFM), fat free mass (FFM), % fat free mass (PFFM) and % total body water (PTBW) were obtained. In addition, pre-operative PSA, biopsy Gleason score, prostate weight, margin status, pathologic Gleason grade, tumor volume, operative time, and estimated blood loss were recorded. We performed a multiple linear regression analysis to evaluate if these BC measures correlated with BMI and accurately predicted post-surgical outcomes.

Results: 28 patients who underwent RARP have been incorporated into this ongoing study. Baseline characteristics of this cohort include mean age 58.8 +/- 5.3 years, mean BMI 28.7 +/- 4.9, mean pre-PSA 6.7 +/- 7.2, median Gleason 3+3 (range 3+3 to 4+5), mean FM 101.3 +/- 41.4 lbs, PFM 20.8 +/- 11.8%, FFM 166.2 +/- 34.4 lbs, PFFM 79.8 +/- 12.0%, and PTBW 61.2 +/- 13.3%. Post-operative histopathology revealed mean prostate mass 55.1 +/- 12.6 g, median Gleason 3+4 (range 3+3 to 4+4), and positive margins were found in 5/28 patients (17.9%). BMI correlated with PFM (p=0.03) and PTBW (p=0.002). BMI also correlated with pre-PSA (p=0.03), prostate weight (p=0.03) and operative time (p=0.04). No BIS metrics correlated with surgical outcomes.

Conclusions: Preliminary data from this registry study evaluation demonstrate good correlation between BMI and BIS-determined PFM and PTBW. Unlike BMI, initial results demonstrate that BIS BC does not predict operative outcomes. Further evaluation is in progress.
EFFECT OF WARM ISCHEMIA TIME ON RENAL FUNCTION AFTER ROBOTIC PARTIAL NEPHRECTOMY

Riccardo Autorino, Georges-Pascal Haber, Michael A. White, Sylvain Forest, Rakesh Khanna, Bo Yang, Fatih Altunrende, Robert J. Stein and Jihad H. Kaouk

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Introduction: Robotic partial nephrectomy (RPN) has emerged recently as a new surgical treatment option for select renal masses. The aim of this study was to assess the effect of warm ischemia time (WIT) on renal function after RPN.

Methods: Between June 2006 and October 2009, 126 patients underwent RPN at our institution for renal tumors. Their medical records were collected prospectively in our RPN database and used for this analysis. Patients were divided into three groups: group A (n=18, mean age 63.4±12.7) included those undergoing an unclamped procedure and having WIT=0; group B (n=55, mean age 61.3±10.8) included those with WIT < 20 min (mean 15.7±3.1); and group C (n=53, mean age 62.3±11.4) included those with WIT > 20 min (mean 27.9±5.2). Estimated glomerular filtration rate (eGFR) according to the MDRD GFR formula and using serum creatinine (sCr) values before surgery and at hospital discharge were determined. Appropriate statistical tests were used to perform the data analyses.

Results: The groups were comparable in terms of patient characteristics (age, BMI, ASA score, preoperative sCr, preoperative eGFR). Mean tumor size was larger significantly in group C (3.58 cm±1.7) versus groups A and B (2.55±1.5 and 2.66±1.2, respectively, p<0.05). There was no significant difference in terms of percentage of eGFR change between the group A and B (mean values -4.97 and -6.18, p=0.35) whereas there was a statistically significant difference between group C (mean value -14.01) and groups A and B (p<0.01). Similarly there was a significant change in terms of sCr between group C (mean value +0.16 ml/dl) and groups A and B (+0.03 and +0.07, respectively; p<0.01).

Conclusion: When WIT was kept below 20 minutes its impact on postoperative renal function after RPN resulted to be minimal in this study population.
“5-MM PORT” LAPAROSCOPIC NEPHRECTOMY: IMPROVED COSMESIS WITHOUT TECHNICAL RESTRICTIONS

Nina Casanova, J. Stuart Wolf, Jr.
University of Michigan, Ann Arbor, MI, USA

Introduction: The latest attempt to improve the cosmesis of laparoscopic surgery is laparoscopic single-site surgery (LESS). We present our initial experience with an alternative procedure that has similar cosmetic benefit but not the technical limitations.

Methods: “5-mm port” laparoscopic nephrectomy is performed transperitoneally using 5-mm ports and a single 12-mm port. A 5mm port is placed in the umbilicus and the 12mm port is placed below the pubic hairline. We assessed our first 21 of 26 transperitoneal non-hand-assisted nephrectomies by single surgeon (JSW) from June 2008 through July 2009. These were matched 1:2 from among 96 controls undergoing the same operation from 2005 through 2008. Matching was by gender and American Society of Anesthesiology score, and then by body mass index (BMI) and age.

Results: The “5-mm port” and control groups were matched well, with mean age and BMI differing by only 3.6 years and 1.1 kg/m², respectively. Of the “5-mm port” patients, 34% were obese, and a trainee was the primary surgeon in 81% of cases. Mean operative time was 23 minutes longer in the “5-mm” cases, but there was no difference from controls in estimated blood loss, complication rate, or convalescence measures.

Conclusions: Like LESS, “5-mm port” nephrectomy provides improved cosmesis. However, it is only slightly more difficult to perform than a standard laparoscopic nephrectomy and can be performed in technically challenging cases (morbid obesity, large specimen, etc). Similar to the literature on LESS, there is no benefit of “5-mm port” nephrectomy in terms of convalescence. The advantage over standard laparoscopy is purely cosmetic.

Port positioning for 5mm protocol with resultant cosmetic outcome postoperatively
ABSTRACT 36

LAPAROSCOPIC ENDOVASCULAR STAPLER MALFUNCTION: HIGH VOLUME LAPAROSCOPIC CENTER EXPERIENCE AND A REVIEW OF THE LITERATURE

Philippe Nabbout, Georges-Pascal Haber, Michael A. White, Riccardo Autorino, Rakesh Khanna, Robert J. Stein and Jihad H. Kaouk

*Glickman Urological and Kidney Institute, Cleveland Clinic*

**Introduction**: Endovascular staplers are used routinely in laparoscopic renal surgery and have simplified the control of renal vasculature. Though uncommon, malfunction of these devices occur and can have catastrophic ramifications. We performed a review of the available literature and retrospectively analyzed the experience at a single high volume laparoscopic institution in order to evaluate the incidence of endovascular stapler malfunction during laparoscopic renal surgery.

**Methods**: We retrospectively reviewed our database of laparoscopic nephrectomies from 1997 to 2008. A total of 1611 laparoscopic nephrectomies were performed at our institution. Chart reviews were conducted to determine etiology of failure, intraoperative management, and possible future prevention. The malfunction rate was divided into preventable (too thick of structures, etc.) and primary mechanical (missing staple line, etc) failure. Additionally, we performed a MEDLINE search for endovascular stapler device use and malfunction during laparoscopic nephrectomy.

**Results**: A total of 8 endovascular complications occurred during 1611 laparoscopic nephrectomies at our institution. A 0.5% malfunction rate was calculated, with primary mechanical failure rate calculated at 0.19% and preventable failure rate at 0.31%. There was no evidence of extended morbidities or mortalities. Malfunction rates in the literature varied from 0% to 1.8% and varied in severity from mild bleeding at the staple line to complete transection of the vessel without ligation.

<table>
<thead>
<tr>
<th>N</th>
<th>sex</th>
<th>Operation</th>
<th>Vessel</th>
<th>Type of malfunction</th>
<th>EBL/Transfusion</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>F</td>
<td>L NU</td>
<td>Renal vein</td>
<td>Bleeding staple line</td>
<td>500cc/no</td>
<td>Control with clips</td>
</tr>
<tr>
<td>2</td>
<td>M</td>
<td>L RN</td>
<td>Renal vein</td>
<td>Bleeding staple line</td>
<td>300cc/no</td>
<td>Control with clips</td>
</tr>
<tr>
<td>3</td>
<td>M</td>
<td>L RN</td>
<td>Renal artery</td>
<td>Bleeding staple line</td>
<td>1900cc/yes (2 units)</td>
<td>Intracorporeal suture</td>
</tr>
<tr>
<td>4</td>
<td>F</td>
<td>R SN</td>
<td>Renal vein</td>
<td>Missing staple line</td>
<td>1000cc/yes (7 units)</td>
<td>Conversion to open</td>
</tr>
<tr>
<td>5</td>
<td>M</td>
<td>R RN</td>
<td>Renal vein</td>
<td>Missing staple line</td>
<td>2000cc/yes (8 units)</td>
<td>Conversion to open</td>
</tr>
<tr>
<td>6</td>
<td>M</td>
<td>R RN</td>
<td>Renal vein</td>
<td>Bleeding staple line</td>
<td>1000cc/yes (3 units)</td>
<td>Control with clips</td>
</tr>
<tr>
<td>7</td>
<td>M</td>
<td>S RN</td>
<td>Renal vein</td>
<td>Bleeding staple line</td>
<td>150cc/no</td>
<td>Additional stapler</td>
</tr>
<tr>
<td>8</td>
<td>M</td>
<td>L RN</td>
<td>Renal vein</td>
<td>Firing problem</td>
<td>300cc/no</td>
<td>Additional stapler</td>
</tr>
</tbody>
</table>

**Conclusion**: Laparoscopic endovascular stapler malfunction is infrequent but a potential occurrence. All users of these devices must be versed in their proper use and well equipped to handle a malfunction should it happen.
**ABSTRACT 37**

**3D COMPUTER-GUIDED TRUS PROSTATE BIOPSY: PILOT STUDY**


*Center for Image-Guided Therapy, USC Institute of Urology, Keck School of Medicine, University of Southern California, Los Angeles, CA*

**Introduction:** Current, standard TRUS biopsies are insufficiently accurate to localize prostate cancer lesions with sub-millimeter accuracy. For the development of a clinically-relevant prostate focal therapy protocol, precise 3D localization of the interventional needle (for biopsy or ablation) is critical. Real-time 3D TRUS with computer-guidance of biopsy needle placement could precisely document the actual location of every biopsy-sampled tissue. Such information would be critical for precise focal therapy targeting. The aim of our study was to determine the accuracy of 3D computer-guided TRUS prostate biopsy using a novel software system (Koelis, France), which is a computer-guided 3D localization system for tracking every biopsy trajectory (Figure 1).

**Methods:** We used 3 prostate phantoms (CIRS Model 053-MM, USA), each containing 3 randomly located hypo-echoic lesions, each of 0.5cc volume. *Methodologic Steps:* (1) Pre-biopsy MR (3 Tesla) of each phantom (1mm slice thickness); (2) Koelis 3D TRUS system used to create an initial 3D image of the phantom (“panorama image”); (3) Needle biopsy #1: using 2D TRUS guidance, a standard 18-gauge biopsy needle targeted into center of each hypoechoic lesion; (4) Registering onto “panorama image”: After biopsy, the needle was left in-situ in the phantom for 3 seconds, during which a 3D TRUS image was created & recorded onto the “panorama image”; (5) Inking each needle track: Inner needle removed, leaving outer needle sheath in place, through which gadolinium-based contrast agent mixed with India ink (black, red, or blue) injected into the needle track as outer sheath gradually removed; (6) Needle biopsies #2 and #3 done at pre-declared target sites with 2D TRUS guidance; (7) Post-biopsy MRI (1-mm slice thickness) of phantom; (8) Step-sectioning the phantom with 1-mm slice thickness; (9) Physical measurement of each needle-track to evaluate accuracy. Thus, spatial accuracy was evaluated by MR scan plus physical measurement.

**Results:** (1) A total of 27 needle biopsies were targeted into 9 hypoechoic lesions; each biopsy (27/27; 100%) successfully hit the target lesion (lesion volume 0.5ml). (2) Success rate of Koelis registration was 96% (26/27); one registration simply missed side of lesion due to a residual mirror-image of previous hyper-echoic needle tract on opposite side. (3) Since each of the 27 needle biopsies pierced the targeted lesion ‘through & through’, each needle track crossed the hypoechoic lesion boundary twice, firstly at the lower boundary, and secondly at the upper boundary of the lesion. Thus total number of needle track crossing points: 27x2=54. Among these 54 crossing points, “no error” (< 1mm) was observed in 30 needle tracks (56%), “minimal error” (1-2mm) was observed in 22 tracks (41%), and “moderate error” (2-3 mm) was observed in 2 tracks (4%). Final Outcome: Our procedural targeting error (i.e., error on MR analysis and/or step-section measurement) was 1.52±0.78mm. The system registration error was 0.83±0.54mm. Thus, mean total targeting error in needle placement was 2.35mm.

**Conclusion:** In our pilot study, the Koelis novel computer-guided 3D localization system achieved encouraging accuracy for registration of needle track biopsies in a prostate phantom. This accuracy may potentially be further increased with automated robotic technology. These approaches are fundamental if the goal of high-precision focal targeted therapy is to be realized.

Figure: In every single biopsy, a 3D TRUS image of biopsy trajectory was created & recorded onto the 3D panorama image
THE CANADIAN STONEBREAKER™ TRIAL: A RANDOMIZED, MULTICENTRE TRIAL COMPARING THE LMA STONEBREAKER™ AND THE SWISS LITHOCLAST® DURING PERCUTANEOUS NEPHROLITHOTOMY

Olga Arsovska¹, Dirk Lange¹, Jamie E. Wright¹, B. Welk ¹, Daniela Ghiculete², R. John D’A Honey², Kenneth T. Pace², Ryan F. Paterson,¹ and Ben H. Chew¹
¹University of British Columbia, Canada, ²University of Toronto, Canada

Introduction: Percutaneous nephrolithotomy (PNL) is the preferred treatment for larger renal stones. A common method of stone fragmentation is using the pneumatic lithotripter, the Swiss LithoClast, powered by compressed air and a hand piece tethered to the generator. The StoneBreaker is a novel hand-held pneumatic lithotripter powered by a compressed carbon dioxide cartridge that delivers 31 bar of pressure compared 6 bar for the Swiss LithoClast. The purpose of this study was to compare the LMA StoneBreaker to the Swiss LithoClast during percutaneous nephrolithotomy.

Methods: From January 2008 to December 2009, patients undergoing PNL were randomized prospectively to either the LMA StoneBreaker (SB) or the Swiss LithoClast (LC). The primary outcomes were the time to (1) fragment the stone, (2) pluck the fragments, and (3) remove debris using ultrasonic (US) lithotripsy. Secondary endpoints were stone-free rate, lithotripter set-up time, ease of use, endoscopic visualization, damage to mucosa, and device-related complications.

Results: Of the initial 115 patients recruited, 77 were enrolled (46 were randomized to SB and 31 to the SL arm); 38 were excluded due to stones being too small (i.e., plucked intact) or too soft. The StoneBreaker was faster significantly at fragmenting stones, at total lithotripsy time, and at set-up time than use of the SwissLithoClast. There also were differences noted in the ease of use and operator fatigue, in favor of the StoneBreaker. There were no device-related complications in either group.

Conclusion: The new StoneBreaker™ pneumatic lithotripter is easier to set-up and use, and it provides significantly faster stone fragmentation than the Swiss LithoClast®.

<table>
<thead>
<tr>
<th>Variable</th>
<th>StoneBreaker™</th>
<th>LithoClast®</th>
<th>Difference; CI range</th>
<th>T test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>46 (24M, 22F)</td>
<td>31 (15M, 16F)</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Age (years)</td>
<td>55.87±13.21</td>
<td>54.55±13.18</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>29.95±8.06</td>
<td>27.60±8.39</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Stone size (mm²)</td>
<td>369 ± 188.1</td>
<td>432.2 ± 298.5</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Rate of Stone Fragmentation (mm²/sec)</td>
<td>6.46* ± 4.16</td>
<td>3.59 ± 2.87</td>
<td>2.87; 2.68 - 3.05</td>
<td>P &lt; 0.001</td>
</tr>
<tr>
<td>Lithotripter set up time (sec)</td>
<td>68.49* ± 51.35</td>
<td>101.9 ± 39.61</td>
<td>33.41; 32.69-34.19</td>
<td>P &lt; 0.001</td>
</tr>
<tr>
<td>Total Lithotripsy Time (sec)</td>
<td>671.3* ± 489.6</td>
<td>1012.5 ± 629.1</td>
<td>341.2; 255.95-426.42</td>
<td>P =0.006</td>
</tr>
<tr>
<td>Ease of use (1-10, 10= simple)</td>
<td>9.33*± 1.43</td>
<td>7.35 ± 3.25</td>
<td>1.98; 1.23-2.74</td>
<td>P &lt;0.001</td>
</tr>
<tr>
<td>Operator fatigue (1-10, 10=none)</td>
<td>9.51 ± 1.46</td>
<td>7.52 ± 2.87</td>
<td>1.99; 1.38-2.61</td>
<td>P &lt;0.001</td>
</tr>
<tr>
<td>Visibility (1-10, 10= adequate)</td>
<td>9.16 ± 1.59</td>
<td>8.39 ± 2.12</td>
<td>0.77; 0.47-1.07</td>
<td>P &gt; 0.05</td>
</tr>
<tr>
<td>Damage renal epithelium (1-10, 10= no damage)</td>
<td>8.75, 2.37</td>
<td>8.19, 2.80</td>
<td>0.56, 0.252-0.861</td>
<td>P &gt; 0.05</td>
</tr>
<tr>
<td>Stone free, Residual fragments: &lt; 4 mm, &gt; 4 mm</td>
<td>SB (53%, 33%, 14%), LC (41%, 48%, 11%)</td>
<td>p=ns</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stone composition (p=ns)</td>
<td>SB: 47%CaOx, 11%CaP, 13%CaOx+CaP, 13%Struvite, 11%UA, 1%Apatite</td>
<td>LC: 58%CaOx, 10%CaP, 20%CaOx+CaP, 3%Struvite, 3%UA, 3%Cystine</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
ABSTRACT 39

MN-PORPHYRINS AS NOVEL MOLECULAR MRI CONTRAST AGENTS


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Introduction: In these experiments, we have investigated a new class of therapeutic metalloporphyrins for their potential as molecular MR imaging probes for prostate cancer detection. Mn(III)TE-2-Pyp5+ (meso-tetrakis(N-ethyl-2-pyrdil)porphyrin) and Mn(III)TnHex-2-PyP5+ (meso-tetrakis(N-n-hexyl-2-pyridyl)porphyrin) are powerful superoxide dismutase mimics with low toxicity and antineoplastic activity.

Methods: MR imaging experiments were performed at 7.0T on a Bruker Biospec horizontal bore scanner. All in vivo experiments were performed on C57 black mice implanted with RM-9 prostate cancer cells on the hind-limb location. 10 mg/kg of MnTn-Hex-2-PyP (n=4) and 2 mg/kg MnTE-2-PyP (n=3) were given intraperitoneally (i.p.) in a single dose. Experiments were performed before and after 60 or 120 minutes following injection. All the images were collected using a volume coil and processed using Paravision 4.0.

Results: Phantom studies reveal remarkably high T1 relaxivity changes for both hexyl and ethyl analogues, which are several-fold higher than commercially available gadolinium chelates (Magnevist, Prohance). Observable detection limits are in the low micromolar range (Figure 1), 1-2 orders of magnitude lower than conventional chelates. In vivo, we readily observe MR relaxation changes in prostate tumor xenografts after a single i.p. injection of either ethyl and hexyl analogues, although T1 shortening was highest after hexyl administration (Figure 2).

Conclusion: Following a single dose of Mn-Porphyrins, relaxation changes in prostate tumors measured 10-11 fold greater than in surrounding tissues, suggesting these probes may be particularly effective at selectively detecting prostate cancer foci in vivo.

Figure 1. Figure 2.
OPTIMAL FREEZE CYCLE IN RENAL CRYOTHERAPY

Jennifer L. Young, Elham Khanifar, Navneet Narula, Cervando G. Ortiz-Vanderdys, Surendra B. Kolla, Donald L. Pick, Petros Sountoulides, Oskar G. Kaufmann, Kathryn E. Osann, Victor B. Huynh, Adam G. Kaplan, Lorena A. Andrade, Michael K. Louie, Elspeth M. McDougall, and Ralph V. Clayman

University of California, Irvine

Introduction: The optimal freeze cycle length and number in renal cryotherapy is unknown. Time-based freeze cycles of 10 minutes were compared to temperature-based freeze cycles to -20°C in a porcine model.

Methods: Laparoscopic percutaneous renal cryotherapy was performed on sixteen pigs. Time-based trials consisted of a double ten minute freeze separated by a five minute active thaw. Temperature-based trials were double cycles of one, five, or ten minute freeze, initiated only once one of four thermal sensors read -20°C. A five minute active thaw was employed between freeze cycles once the same sensor read 0°C. Control trials consisted of cryoneedle placement for 25 minutes, without freeze or thaw. Immediate viability staining and histologic analyses were performed.

Results: There was no difference in cellular necrosis between any of the temperature-based freeze cycles (p=0.0977). Time-based freeze cycles showed no difference in cellular necrosis than temperature-based freeze cycles for medulla (p=0.61) but showed more necrosis than temperature-based freeze cycles for cortex (p=0.05). Mean time to -20°C for the first freeze cycle was 19 minutes 10 seconds (range 9-46 min). In four of 21 trials (19%), -20°C was never reached despite freezing for 25-63 minutes.

Conclusion: There was no difference in immediate cellular necrosis between double 1, 5 or 10 minute freeze cycles. Cellular necrosis was evident on histologic analysis for trials in which -20°C was attained and in freeze cycles based on time alone. With a standard ten minute cryoablation period, the majority of treated parenchyma 1 cm from the probe never reaches 20°C. Cell death appears to occur at temperatures warmer than -20°C in renal cryotherapy.

Figure: Gross axial section of kidney after immediate viability staining
ABSTRACT 41

GELPOINT™ PLATFORM FOR UROLOGICAL LESS: EARLY EXPERIENCE

Rakesh Khanna, Robert J. Stein, Riccardo Autorino, Georges-Pascal Haber, Michael A. White, Sylvain Forest, Bo Yang, Fatih Altunrende, Mark Noble and Jihad H. Kaouk
Glickman Urological and Kidney Institute, Cleveland Clinic, Cleveland, OH, USA

Introduction: Herein we describe our early clinical experience with the newly designed GelPoint™ platform (Applied Medical, Rancho Santa Margarita, CA, USA) for LESS.

Methods: The GelPoint™ features a GelSeal™ gelatin platform for port placement, an Alexis™ wound retractor for fixation to the abdominal wall, self-retaining, low profile trocars, and a built-in valve for insufflation (Figure 1). Potential advantages compared to other platforms may include a large outer working profile providing better triangulation and use of an assistant port, accommodation and optimal benefit from 1.5 cm to 7 cm incisions with varied abdominal wall thickness, and low profile ports leading to decreased clashing. The design is similar to the GelPort™ platform but with a smaller diameter. Perioperative outcomes were analyzed for patients undergoing urologic LESS surgery using this device at our Institution.

Results: Five patients (mean age 46.6 years, range 22-69; mean BMI 24.6, range19-30) underwent the following LESS procedures: pyeloplasty (n=1), retrocaval ureter repair (n=1), robotic radical prostatectomy (n=1), radical nephrectomy (n=2). No case required conversion to open or conventional laparoscopic surgery. For all cases the GelPoint™ device did not require exchange for a new device due to mechanical failure (Table 1).

Conclusion: The Gelpoint™ platform for single-site access has provided advantages for performing LESS urologic surgery, mostly by allowing greater spacing for either laparoscopic and robotic instruments and easier assistant access. Ideally, studies are needed to compare different purpose-built access devices for LESS.

Table 1. Main perioperative outcomes

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Operative time (min)</th>
<th>EBL</th>
<th>Intraop complication</th>
<th>Postop complication</th>
<th>Accessory instruments</th>
<th>Hospital stay</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pyeloplasty</td>
<td>300</td>
<td>50</td>
<td>None</td>
<td>None</td>
<td>2 mm grasper</td>
<td>3</td>
</tr>
<tr>
<td>Retrocaval ureter repair</td>
<td>180</td>
<td>50</td>
<td>None</td>
<td>None</td>
<td>2 mm grasper</td>
<td>2</td>
</tr>
<tr>
<td>Robotic radical prostatectomy</td>
<td>180</td>
<td>350</td>
<td>None</td>
<td>Ileus</td>
<td>None</td>
<td>6</td>
</tr>
<tr>
<td>Robotic radical nephrectomy</td>
<td>210</td>
<td>200</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>2</td>
</tr>
<tr>
<td>Robotic radical nephrectomy</td>
<td>210</td>
<td>50</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>3</td>
</tr>
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</table>

Figure 1. Gelpoint™ platform (Applied Medical, Rancho Santa Margarita, CA, USA).
ABSTRACT 42

ROBOTIC EXTENDED PELVIC LYMPHADENECTOMY FOR BLADDER CANCER WITH INCREASED NODAL YIELD

Humberto Martinez-Suarez, Hugh Lavery, Ronney Abaza
Ohio State University Medical Center and James Cancer Hospital

Introduction: The extent of pelvic lymphadenectomy at the time of cystectomy has been shown to impact patient survival. Increased nodal yield improves staging accuracy and has demonstrated survival benefit. The oncologic efficacy of laparoscopic or robotic extended lymphadenectomy (ePLND) has been questioned due to the lower mean nodal yields reported with these techniques as compared with centers of excellence for open cystectomy. We describe our initial experience with robotic extended PLND for bladder cancer, reproducing open templates and focusing on maximal nodal yield.

Methods: Fifteen consecutive patients underwent robotic radical cystectomy with ePLND by a single surgeon (RA). The ePLND template used in all patients was bounded by the genitofemoral nerves laterally, the node of Cloquet distally, approximately 2 cm above the bifurcation of the aorta proximally, and the midline over the sacrum medially. Circumferential skeletonization of the common, external, and internal iliac vasculature was performed and the fossa of Marcille (pre-sciatic space) fully dissected. Operative time, time to perform ePLND, pathologic stage, estimated blood loss (EBL), length of hospital stay (LOS), number of nodes obtained, and nodal positivity were assessed. Postoperative complications and readmissions were also reviewed.

Results: The mean age and BMI were 66 years (46-87) and 29kg/m² (22-43), respectively. Four patients had neoadjuvant chemotherapy. Five patients were stage pT0, three pTis, one pT1, two pT2, three pT3 and one pT4. The mean operative time and ePLND time were 423min (300-506) and 107min (66-160), respectively. Mean EBL was 160mL (50-500). The mean and median length of hospital stay were 3.4 days (3-7) and 3 days, respectively. The mean nodal yield was 41.8 nodes (18-67) with greater than 25 nodes in 85% of patients. Three patients (20%) were found to have nodal positivity. Two patients were readmitted for postoperative complications within 30 days, but there were no complications directly resulting from the ePLND.

Conclusions: Robot assisted ePLND at the time of cystectomy can be safely and effectively performed on the robotic platform with comparable nodal yields to published open series at centers of excellence. Nodal yields are likely a factor of the effort of the surgeon, not the method by which the lymphadenectomy is performed.

Figure: Examples of open extended lymph node dissection and same dissection performed robotically
ABSTRACT 43

A VALIDATION STUDY OF THE STUDY-SPECIFIC PELVIC MODELING APPROACH

Yingchun Zhang¹, Arthur G. Erdman², Gerald W. Timm¹

¹Urologic Surgery, ²Mechanical Engineering, University of Minnesota

Introduction: A subject-specific pelvic modeling approach has been developed to non-invasively assess urethrovaginal support function which is an etiologic factor associated with stress urinary incontinence (SUI) in female. A validation study has been conducted to evaluate the performance of this approach in preparation for applying it to clinical population.

Methods: A 22-year-old female subject was recruited to participate in this University of Minnesota IRB approved study. Axial proton density and coronal T2-weighted high resolution MR images were obtained on the subject with a 3.0 Tesla scanner using a commercially available combined body-spine coil array for reception. The subject’s specific pelvic model was constructed from her MR images using the subject-specific FE pelvic mesh model generation procedure. The BTS SMART-e motion capture system (BTS SMART, BTS S.p.A.) as shown in Figure 1 (a) and (b) was used to simultaneously measure dynamic biomechanical response and landing impact of her pelvis when she lands a jump. Reflective markers were fixed over the lower back to measure the landing impact of the pelvic bones [Figure 1 (e)] and other markers were fixed over other points of her pelvis to measure the induced biomechanical response [Figure 1(d)]. The subject jumped off from a 0.5 feet-high table. The motion of each reflective marker was captured and corresponding landing velocities and accelerations were calculated. The dynamic structure-fluid interaction finite element (FE) analysis was performed using velocities of the left back marker to simulate dynamic biomechanical response of the pelvis. The simulated dynamic biomechanical responses were compared with the simultaneous recordings at same markers to evaluate the proposed pelvic modeling approach.

Results: The female pelvic FE model developed in this study consists of 35 anatomical parts including 10 pelvic muscles, 10 pelvic ligaments, 6 pelvic bones, skin, fat tissues, bladder, urethra, uterus, vagina, colon, rectum and anus. Figure 2 shows the velocity recordings of two markers of the pelvis, and we can clearly see the deference of dynamic measurements between the pelvic bone (Left Back Marker) and other soft organs (Left Belly marker). These measurements will be used to evaluate the performance of our pelvic modeling approach.

Conclusion: Evaluation results will be presented at the conference upon the completion of this study.
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ROBOT-ASSISTED RADICAL CYSTECTOMY AND PELVIC LYMPHADENECTOMY: A LARGE SERIES

Peter Hinds, Mutahar Ahmed, Gregory Lovallo, Michael Esposito, Vincent Lanteri

Hackensack University Medical Center, UMDNJ - New Jersey Medical School, New Jersey

Introduction:  Robot-assisted radical cystectomy (RARC) with pelvic lymphadenectomy is a relatively new approach. Since the initial introduction of the daVinci robotic system, its use has expanded to include many extirpative surgeries of the urinary system. We gained our experience with robotic surgery through robotic prostatectomy and found that transition to radical cystectomy was without difficulty. We present our initial experience.

Methods:  Over 3.5 years sixty-three RARC were performed. All cases were performed by a single group of surgeons. The four arm daVinci robotic system was used. Robot-assisted pelvic lymphadenectomy extended from the node of cloquet to the bifurcation of the common iliac vessels. We exclusively used one left sided assistant port. A 5-7cm paraumbilical incision was employed to aid in extracorporal urinary diversion creation. The primary endpoint was surgical margin. Secondary endpoints included perioperative outcomes and pathologic results.

Results:  63 patient charts were reviewed; 41 men and 22 women. Mean age was 74.5 years. Urinary diversions include 43 ileal conduits, 14 ileal neobladders, and 6 Indiana pouches. 16 patients had prior abdominal surgery, including 1 partial cystectomy, and 9 patients had external radiation for prostate cancer. The mean operating time for RARC and pelvic lymphadenectomy was 88.9 minutes. We found that prior radiation and abdominal surgery did not hinder successful case completion as no cases were converted to open. 7 patients (11.7%) required blood transfusion(s). All patients with organ confined disease defined as ≤ pT3a disease had negative surgical margins with only 1 patient (2%) demonstrating nodal disease. The mean numbers of recovered lymph nodes were 14. The mean time to initial flatus was 3.2 days, with a mean length of stay of 5.4 days. There were 2 major perioperative complications. There were no deaths.

Conclusions:  We found from our experience that RARC and pelvic lymphadenectomy can be performed safely and in a timely fashion with acceptable oncologic results and perioperative outcomes when compared to open radical cystectomy reported elsewhere in the literature.
ABSTRACTS

ABSTRACT 45

COMBINED ROBOT-ASSISTED LAPAROSCOPIC CYSTECTOMY-NEPHROURETERECTOMY: AN INITIAL SERIES

Lori Jones1,2, Mutahar Ahmed1, Gregory Lovallo1, Vincent Lanteri1, Michael Esposito1
1 Hackensack University Medical Center, 2 University of Medicine and Dentistry of New Jersey

Introduction: Patients with concomitant muscle invasive transitional cell carcinoma of the bladder and upper tract urinary tumors may be candidates for simultaneous cystectomy and nephroureterectomy. Improved recovery times with equivalent oncologic outcomes have been reported with a laparoscopic versus open approach. We present our experience with robotic assisted laparoscopic cystectomy combined with laparoscopic nephroureterectomy.

Methods: In a 1.5 year period a total of 5 patients (4 males, 1 female), mean age 79 years (range 75-86), underwent simultaneous robot-assisted radical cystectomy and hand-assisted laparoscopic nephroureterectomy. The indication for upper tract surgery was synchronous TCC in 4 patients and Xanthogranulomatous pyelonephritis in 1 patient. Indication for cystectomy was muscle invasive urothelial carcinoma in all 5 patients. Patients first underwent standard hand-assisted laparoscopic nephrectomy with kidney and ureter left in continuity with the bladder. The daVinci S robot then was used for cystectomy with 4 robot arms and one assistant port. All patients underwent bilateral pelvic lymphadenectomy. Ileal conduit diversion was performed through the 5-7cm infra or supraumbilical incision made for the nephroureterectomy hand port.

Results: A total of 5 patients (4 males, 1 female) mean age 75 years (range 68-82) underwent simultaneous robot assisted radical cystectomy and hand assisted laparoscopic nephroureterectomy (Table 1). Average operating time for nephroureterectomy was 56 minutes (range 51-62), average time for cystectomy was 94 minutes (range 85-113), and average time for urinary diversion was 74 minutes (range 69-80). Overall mean operative time was 224 minutes (range 209-238). Mean estimated blood loss was 310cc. No cases were converted. Bowel function, defined as tolerance of solid diet, returned in an average of 3.4 days, average length of stay was 5.8 days. One patient required blood transfusion postoperatively and one patient developed transient ATN which resolved prior to discharge. Final pathologic stage was comparable to preoperative work up staging. Mean follow-up was 9 months (range 6-13 months). No patients developed distant metastatic disease and there were no mortalities. One patient developed local urethral recurrence 11 months postoperatively and subsequently underwent urethrectomy.

Conclusion: We found cancer control and morbidity in combined robotic cystectomy and laparoscopic nephroureterectomy comparable to our experience with the standard open technique. Longer follow-up and a greater number of patients are required to confirm these findings.

Figure: Postoperative scars following combined robot-assisted laparoscopic cystectomy-nephroureterectomy
PALPATION DEVICE FOR THE IDENTIFICATION OF KIDNEY AND BLADDER CANCER: A PILOT STUDY

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¹Department of Urology, Yonsei University, Seoul, Korea, ²School of Mechanical, Aerospace & Systems Engineering, Department of Mechanical Engineering, Korea Advanced Institute of Science and Technology, Daejeon, Korea

Introduction: To determine if the palpation device we developed can measure tissue elasticity and if it can differentiate benign and malignant tissues of the kidney and bladder.

Methods: Using the palpation device we developed, tissue elasticity was measured in both benign and malignant tissues of the kidney and bladder. Twelve kidney and four bladder specimens were used to undergo a palpation ex vivo experiment by a single investigator. We developed a palpating device mainly composed of a micromotor, linear position sensor, a force transducer, and a hemisphere tip and cylindrical body probe. It underwent motion calibration as well as performance validation. Experiments were carried out on the cancer in partial nephrectomy specimen and normal kidneys from nephroureterectomy specimens and directly on the area of the bladder cancer and in normal bladder areas from radical cystectomy specimens. Elastic modulus (Young’s modulus) of tissues was estimated using the Hertz-Sneddon equation from the experimental results. These were then compared using t-test for independent samples.

Results: Results from renal cell carcinoma were significantly different from normal kidney tissues (p=0.002) as well as urothelial carcinoma of the bladder from normal bladder tissues (p=0.003). Renal cell carcinoma tissues appear to be softer than normal kidney tissues whereas urothelial bladder cancer was harder than normal bladder tissues.

<table>
<thead>
<tr>
<th>Tissue Type</th>
<th>n of readings</th>
<th>Elasticity modulus (kPa)</th>
<th>p-value (normal vs. cancer)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal kidney</td>
<td>36</td>
<td>19.2 (±10.8)</td>
<td>0.002</td>
</tr>
<tr>
<td>Renal cell carcinoma</td>
<td>56</td>
<td>13.0 (±8.2)</td>
<td></td>
</tr>
<tr>
<td>Normal bladder</td>
<td>29</td>
<td>4.7 (±3.7)</td>
<td></td>
</tr>
<tr>
<td>Urothelial carcinoma</td>
<td>14</td>
<td>13.5 (±9.0)</td>
<td>0.003</td>
</tr>
</tbody>
</table>

Conclusion: Elastic modulus of the tissues can be determined by our palpation device. It has the potential to differentiate malignant and benign kidney and bladder tissues. Further studies are necessary to verify this potential and define its true clinical utility.

Figure: Experimental setup of the palpation device
ABSTRACT 47

COMPARING THE DAVINCI SI™ AND DAVINCI S™ ROBOT SURGICAL SYSTEMS: IS THERE A DIFFERENCE?

Kurt H Strom, Massimiliano Spaliviero, Xiao Gu, Carson Wong

University of Oklahoma Health Sciences Center

Introduction: da Vinci robot surgical systems (Intuitive Surgical, Sunnyvale, CA) have revolutionized prostate surgery. Recently, the da Vinci Si™ was introduced, having enhanced features compared to its predecessors. We review these enhancements and contrast them to features of the da Vinci S™ system.

Methods: Features of the da Vinci Si™ and S™ surgical systems were reviewed. The novel features of the da Vinci Si™ model are highlighted.

Results: Both the da Vinci Si™ and S™ systems offer 3D vision with up to 10x magnification with either 0° or 30° endoscopes; motion scaling with tremor filtration; 7° of freedom, 180° articulation and 540° rotation in the arms; 5 and 8 mm platforms; multiple instruments and a height-adjusting console. Unique features of the da Vinci Si™ system include the option of two consoles, offering the capability for surgeon and trainee exchange of one or more instruments and the endoscope to facilitate training. As well, the potential for dual surgeon robot-assisted procedures is introduced. The multi-axis adjustable console gives ergonomic tailoring for each individual surgeon. Fingertip controls of the console allow seamless master repositioning and control of camera focus and zoom, while touchpad controls complete the system integration. The 3D high-definition (1080i per eye) visual system improves vertical digital image resolution. Video footage that highlights these features will be presented.

Conclusion: These enhancements make the da Vinci Si™ the first fully integrated 3D high-definition robot surgical system. It has the potential for greater ease of use, improved surgeon training and expansion of robot-assisted surgery.

Figure 1: da Vinci Si™ and S™ Surgical Systems
ABSTRACT 48

PHOTO-SELECTIVE VAPORIZATION OF PROLENE (POLYPROPYLENE) MESH USED IN STRESS URINARY INCONTINENCE AND HERNIA PROCEDURES: PRELIMINARY STUDIES

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1 Department of Physics and Optical Science, University of North Carolina, Charlotte, NC
2 McKay Department of Urology, Carolinas Medical Center, Charlotte, NC
3 Department of Urology, Johns Hopkins Medical Institutions, Baltimore, MD

Introduction: There are about 200,000 sling procedures for female stress urinary incontinence and pelvic organ prolapse, and about 700,000 hernia repairs performed each year in the United States. A significant number of these procedures use a non-absorbable prolene (polypropylene) mesh placed inside the body for reinforcement. In 5-10% of these procedures, complications of mesh exposure, extrusion, and erosions may arise, requiring surgical removal and replacement of the mesh. During these surgical revisions, it may be tedious to cut out the mesh material without damaging healthy tissue, since the mesh is designed to support tissue in-growth. This preliminary study explores selective laser vaporization and removal of non-absorbable prolene mesh materials.

Methods: Preliminary studies vaporizing 300-µm-diameter prolene sutures used a compact, 660 nm red diode laser with a maximum power of 180 mW, a spot size of 170 µm and pulse duration of 100 ms. This study was repeated on blue prolene (polypropylene) mesh with strand diameters of 200 µm, and an effective dwell time of 57 ms. To provide larger laser spot sizes and improved alignment, another laser with a wavelength of 808 nm and a maximum power of 30 W was also tested. Spot sizes ranged from 0.85 to 2.5 mm with a pulse duration of 100 ms at 2 Hz and average powers from .64 to 4.78 W were used to vaporize the mesh. The 660 nm and 808 nm laser wavelengths were selected because absorption by water and hemoglobin in soft tissues is low from 600 - 1300 nm, and absorption by the prolene mesh is high for wavelengths from 500 - 850 nm.

Results: With the 808 nm laser, the vaporization threshold was 0.79 J for a 100 ms pulse and a 1.4-mm-diameter laser spot. For clean vaporization of thick knots (Figure 1), higher powers were necessary. A thermal camera was used for mapping temperatures during laser vaporization of the mesh embedded in soft tissue. While the temperature reached over 170°C in the mesh (above the prolene melting temperature), there was no visual evidence of thermal damage to adjacent tissue. However, more rigorous studies need to be performed with more precise histologic indicators of thermal damage.

Conclusion: It is feasible to vaporize prolene mesh selectively in an efficient manner with minimal thermal damage to surrounding healthy tissue. Although absorption at the 660 nm wavelength is higher than at the 810 nm wavelength for blue prolene mesh, the 810 nm laser provides higher power delivery at less cost.

Figure 1: Blue prolene mesh (a) before and (b) after laser irradiation (wavelength = 808 nm, pulse duration = 100 ms, pulse energy = 0.89 J, and spot diameter = 1.35 mm).
ABSTRACT 49

COMPARISON OF 2.6 MM AND 1.4 MM IMAGING PROBES FOR CONFOCAL LASER ENDOMICROSCOPY OF THE URINARY TRACT

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¹ Department of Urology, Stanford University School of Medicine, Stanford, California
² Veterans Affairs Palo Alto Health Care System, Palo Alto, California

Introduction: Probe-based confocal laser endomicroscopy (pCLE) is an emerging technology for dynamic, in vivo imaging of the endoluminal tracts with micron-scale resolution. A key advantage of pCLE is the availability of different size imaging probes compatible with standard medical endoscopes for applications in the gastrointestinal, respiratory, and urinary tracts. We previously reported the first in vivo feasibility study of pCLE in the urinary tract, using a 2.6 mm diameter probe. In this study, we updated our experience with the 2.6 mm probe and conducted a comparative analysis with a smaller 1.4 mm probe, which is compatible with standard rigid and flexible cystoscopes.

Methods: With IRB approval, patients scheduled for cystoscopic biopsy or transurethral resection of bladder tumors (TURBTs) were recruited. Following white light cystoscopy, intravesical or intravenous fluorescein was administered as previously described to provide tissue contrast during pCLE. The Cellvizio system was used (Mauna Kea Technologies, Paris, France) for pCLE. Either the 2.6 mm probe (GastroFlex UHD®) or the 1.4 mm (AlveoFlex®) was used for in vivo imaging (Table). The 2.6 mm probe fits in the working channel of a standard 26 Fr resectoscope (Storz) while the 1.4 mm probe fits in the standard 15 Fr flexible or a 21 Fr rigid cystoscope (Storz). Sterilization of the probes was done using the STERRAD system immediately after each use. Confocal images were compared with standard hematoxylin and eosin (H&E) analysis.

Results: To date, 53 patients have been recruited for pCLE (2.6 mm probe, n=40; 1.4 mm probe, n=13). With the 1.4 mm probe, confocal images of normal urothelium, inflammation, and neoplasia (low and high grade TCC) were acquired. Overall, the image quality with the 2.6 mm probe was superior, related to the image resolution and the depth of focus. The 1.4 mm probe has a wider field of view, resulting in expanded view of the tissue microarchitecture but reduced view of the cellular morphology (Fig. B & E), which is important to differentiate between high and low grade TCC. With the 1.4 mm probe in place, visualization is diminished during flexible cystoscopy but maneuverability remained acceptable (i.e. retroflexion possible).

Conclusion: We report the initial feasibility study of pCLE in the urinary tract with the 1.4 mm probe and a comparative analysis with the 2.6 mm probe. The probe specifications of the 2.6 mm probe is superior for pCLE in the urinary tract. With further optimization of the probe design and additional validation, the smaller probe size may be a useful adjunct to flexible cystoscopy, raising the possibility of introducing optical biopsy using pCLE to the office setting for diagnosis of urinary tract pathology and bladder cancer surveillance.

Table. Specifications of the 2 probes.

<table>
<thead>
<tr>
<th></th>
<th>2.6 mm</th>
<th>1.4 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diameter (µm)</td>
<td>1 µm</td>
<td>3.5 µm</td>
</tr>
<tr>
<td>Length (µm)</td>
<td>240 µm</td>
<td>600 µm</td>
</tr>
<tr>
<td>Angle (°)</td>
<td>60 °</td>
<td>0 °</td>
</tr>
</tbody>
</table>

Figure. Comparison of the confocal images acquired with the 2.6 mm (A) and the 1.4 mm confocal probe (D) against 2 different papillary tumors. Note the difference in the field of view as shown by the scale bar between the two probes (B and E). Corresponding H&E showing low grade (C) and high grade (F) TCC.
NOVEL PROSTATE BIOPSY TEST IN THE DIAGNOSIS BETWEEN BENIGN AND CANCEROUS PROSTATE BY FRACTIONATED SUB-CELLULAR PROTEIN APOPTOSIS BIOMARKER

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INTRODUCTION AND OBJECTIVES: Prostate cancer (PCa) detection using PSA, digital rectal exam (DRE), PCA3+, and standard twelve core ultrasound guided biopsies (TRUS) are not always accurate in predicting diagnosis. EDGETEST (ET) is a new sub-cellular separation, identifying protein biomarker GRP78, in prostate cancer tissue biopsies. The objective is to evaluate if ET can predict PCa biological activity throughout the entire prostate rather than individually targeted biopsies.

METHODS: Prospectively over a six month period with 18+ months follow-up after initial biopsy, 24 patients, (age 48-80) with either elevated PSA, abnormal DRE, and/or elevated PCA3+ had 12 core TRUS prostate biopsies performed by one urologist. At the time of biopsy, two random core biopsies, one per lobe, were analyzed by the ET test for apoptosis prostate marker GRP78, and were blinded against all clinical and pathological data. Sub-cellular apoptosis ratios of the two cores were unblinded and analyzed against the number of positive PCa biopsy cores and those biopsies negative for cancer. Negative prostate biopsy patients were followed for 18+ months.

RESULTS: Biopsy results showed 8/24 patients (33%) had prostate cancer diagnosed on initial biopsy. The number of positive biopsy cores for cancer were from 2-12/12 (mean 6.1). ET with only two random biopsies correlated with 7/8 (87.5%) diagnosed with a prediction of cancer by analyzing apoptosis marker GRP78. Of the 16/24 (67%) remaining patients initially negative for prostate cancer, 15/16 (93.8%) were correctly correlated by ET with non-cancerous disease after 18 months of follow-up. ET false/positive rate was 1/16 (6.25%) and cancer has not been detected on follow-up. ET had a false/negative of 1/16 (6.25%) initially for cancer. In total, ET was consistent with 14/16 (87.5%) of these patients based on initial biopsy showing highly predictive clustering ratios of benign versus PCa. Seven-out-of-nine (78%) of PCa was detected by edge separation on initial biopsy.

CONCLUSIONS: EDGETEST’s two random biopsies had strong correlation with biological cellular translation of PCa activity by evaluating apoptosis. Findings were consistent over 18+ months follow-up. EDGETEST deserves further evaluation as a complimentary predictor of PCa and shown to be dramatically more effective than DRE, PSA or PCA3+.
PERCUTANEOUS CRYOABLATION OF RENAL MASSES: THE IMPACT OF PATIENT SELECTION AND TREATMENT PARAMETERS ON OUTCOMES

Gino Vricella, MD, Lee Ponsky, MD, John Haaga, MD, Nickolas Boncher, MD
UH Case Medical Center, Cleveland Heights, Ohio

INTRODUCTION: Although traditionally viewed as a treatment option reserved for patients who were felt to be poor candidates for extirpative therapy, ablative therapies now are offered increasingly as a first-line treatment option for patients with incidentally discovered small renal masses. We evaluated whether this trend in patient selection or perioperative parameters affected treatment outcomes after percutaneous cryoablation (PCA) of renal masses.

METHODS: We retrospectively analyzed our urologic oncology database and identified 51 patients treated for a total of 53 renal masses. Univariate analysis was performed to evaluate whether the variables of age, gender, tumor size, number of probes used, total freezing time, preoperative creatinine, or age-adjusted Charlson comorbidity index (CCI) score had an impact on the outcomes of treatment failure or the complication rate.

RESULTS: During a mean follow-up time of 18 months, recurrence-free survival was 94.4%. Overall and disease-specific survival rates were 97.2% and 100%, respectively. The mean age-adjusted CCI score for patients with postoperative complications was 6.5, as compared to a mean score of 3.0 in those patients without postoperative complications (p=0.02). The complication rate was also significantly higher when a greater number of cryoprobes were used during PCA (p<0.005). When patients were stratified by comorbidities, the group with an age-adjusted CCI score greater than or equal to 5 had significantly higher rates of complications and treatment failures following cryoablation than patients with an age-adjusted comorbidity score of less than 5 (p= 0.0002).

CONCLUSIONS: Of the pre- and intraoperative variables studied, age-adjusted Charlson comorbidity index score and number of cryoprobes used were the only variables with predictive value for outcomes in regards to treatment failure or complications. As we expand our indications for cryoablation of renal masses, it is important to be able to counsel our patients completely and honestly regarding the likelihood of complications and the need for subsequent therapy in the setting of treatment failure.
ABSTRACTS

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NATURAL ORIFICE TRANSLUMENAL ENDOSCOPIC SURGERY (NOTES) ACCESS: TRANSVESICAL, TRANSVAGINAL, TRANSCOLONIC, AND TRANSGASTRIC

Michael A. White, Georges-Pascal Haber, Sylvain Forest, Riccardo Autorino, Rakesh Khanna, Bo Yang, Fatih Altunrende, Robert J. Stein and Jihad H. Kaouk
Glickman Urological and Kidney Institute, Cleveland Clinic

Introduction: Natural orifice transluminal endoscopic surgery (NOTES) is an exciting concept that marries flexible endoscopy with laparoscopic surgery. Currently, four natural points of access have been attempted: transvesical, transvaginal, transcolonic, and transgastric. Herein we describe each of our access techniques.

METHODS: Using both the swine and canine model, we were able to access and close the peritoneum in a transvesical, transvaginal, transcolonic, and transgastric manner. Transvesical access to the peritoneum took place using an Olympus CYF-V2 cystoendoscope and needle knife cautery. After successfully penetrating the urinary bladder, with the electrocautery a coronary dilator is used to pass the small scope through the opening. During transvaginal procedures, a colpotomy was created in the posterior wall of the vagina using a needle knife cautery and dilated using Olympus Swift balloon dilator. Afterward, the GIF-Q180 endoscope was advanced over the balloon through the dilated colpotomy. Instruments used during access in transcolonic and transgastric cases include an over tube with dilator, Olympus dual (160/180) and single channel (T130) endoscopes, needle knife cautery, and an Olympus SWIFT balloon dilator. Similar techniques are employed to enter the peritoneum after balloon dilatation.

RESULTS: Transvesicular access has been successful with an average time to enter of 34 minutes. Transvaginal access has been approximately 52 minutes. Transgastric and Transcolonic are greater than 90 minutes on average, with a wide range.

CONCLUSION: All four types of access are feasible and offer excellent visualization of the surrounding tissues and organs. Accessing distant sites from the peritoneal entry site and doing procedures requiring fine manipulations is still difficult and will require further development of NOTES instruments. We are optimistic that as procedures and instruments are developed and refined, it is expected that NOTES to become part of the endoscopist’s armamentarium.
COMPARISON OF PERIOPERATIVE OUTCOMES BETWEEN CONVENTIONAL AND ROBOT-ASSISTED LAPAROSCOPIC PARTIAL NEPHRECTOMY: EXPERIENCE OF A FELLOWSHIP-TRAINED LAPAROSCOPIC SURGEON

Wilmer B. Roberts and Li-Ming Su

Introduction: The utility of the robot in facilitating intracorporeal dissection and suturing may prove to be of benefit in nephron-sparing surgery where the potential for significant hemorrhage and renal dysfunction depends largely on the efficiency with which one performs complex laparoscopic maneuvers. We sought to compare conventional laparoscopic with robotic partial nephrectomy to assess whether the robot provides significant clinical benefit in the hands of a fellowship-trained laparoscopic surgeon.

Methods: Using a prospectively-collected database of procedures performed between January 2007, and November 2009, seventy-seven consecutive patients were identified having undergone laparoscopic or robotic partial nephrectomy by a single surgeon. Perioperative outcomes were compared between the laparoscopic and robotic groups using two-sample t-test or chi square statistics.

Results: The mean age of the patients was 57 years (range 24 to 83 years). Forty-nine cases (63.6%) were performed using conventional laparoscopy and 28 (36.4%) were performed with robotic assistance. The two groups (laparoscopic vs. robotic) were comparable with regard to age (mean 57 vs. 56 years, p=0.06), mean tumor size (2.23 vs. 2.58 cm, p=0.2) and pathologic stage (p=0.3) with 84.4% of tumors pT1a and 10.4% pT1b. While no positive margins were found in the laparoscopic group, a single focally positive margin was noted in the robotic group (3.6%), p=0.2. While there was no difference among the means for total operative time (233 vs. 215 min., p=0.1), estimated blood loss (112 vs. 97 mL, p=0.5), change in hematocrit at discharge (7.1 vs. 5.8%, p=0.2), change in creatinine at discharge (0.11 vs. 0.2 mg/dL, p=0.09) or length of stay (2.7 vs. 2.5 days, p=0.5), warm ischemia time was significantly lower in the robotic series (mean 26.0 minutes, range 14-45) compared to the laparoscopic series (mean 29.5 minutes, range 17-48, p=0.04).

Conclusions: Utilization of the robot improves the efficiency of intracorporeal dissection and renorrhaphy during laparoscopic partial nephrectomy as evidenced by the shorter warm ischemia time. While decreasing warm ischemia might minimize acute tubular necrosis and associated renal dysfunction, no benefit was observed in this series where the means for warm ischemia time for both approaches were less than 30 minutes. Benefit of robotic-assistance during partial nephrectomy may be derived for surgeons with limited laparoscopic training whose average warm ischemia time routinely exceeds 30 minutes.
GUIDEWIRES: LUBRICITY AND SHAFT STIFFNESS

Kari Hendlin, Emily Korman, Manoj Monga

University of Minnesota

Introduction: To evaluate five commonly used guidewires for physical characteristics important for clinical application.

Methods: The guidewires tested were the 0.035” Sensor, Amplatz superstiff and Glidewire (Boston Scientific) and the U-Nite and NiCore (Bard Urological). Force was measured with a 2lb. Wagner FDIX digital force gauge, anchored to a hand-driven linear motion stage. Friction force was measured by pulling wetted guidewires 1 cm through 36mm thick disks of uniform biological material. Shaft stiffness was measured as the peak force required to compress a 30 cm length of guidewire shaft in a clamp-clamp configuration during a move of 25 mm.

Results: Friction force was lowest with the U-Nite (0.09±0.03N), NiCore (0.18±0.10N) and Glidewire (0.16±0.05N) (p<0.05). Shaft stiffness was strongest for the Amplatz (1.80±0.91N), with neither hybrid wire demonstrating high shaft stiffness (NiCore 0.52±0.21, Sensor 0.80±0.29),p<0.05.

Conclusion: The Bard U-Nite has the highest lubricity; a characteristic important for maneuvering around impacted stones. The Amplatz superstiff has the highest shaft stiffness, making it optimal for placement of access sheaths or larger ureteral stents.
ABSTRACT 55

A SYSTEM FOR LAPAROSCOPIC SURGERY ERGONOMICS AND SKILLS EVALUATION

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1 McMaster University, ECE Department
2 St. Joseph Healthcare Hamilton, McMaster Institute of Urology

Introduction: Minimally invasive surgeries have become increasingly popular due to their benefits for the patient, but at a cost to the comfort of the surgeon. The restricted operating access can often lead to surgeons being exposed to longer periods of uncomfortable positions. Also, the newness of the procedure means surgeons are still acquiring the required skills and different instruments are still being designed. Primarily, new instruments and young surgeons are both analyzed using only subjective means. A system is proposed that has to ability to track both the instrument motions as well as the surgeon’s posture. The captured trajectories can then be objectively analyzed for both ergonomic assessment when comparing different instruments, and a skills evaluation when comparing surgeons.

Methods: The system consists of several IR markers attached to the laparoscopic instruments, elbows and shoulders. A compact infrared camera is used for tracking the markers during a standardized training task (e.g. suturing); the tracking data provides the trajectories of the instruments during the procedure. The Figure shows markers attached to laparoscopic instruments. These trajectories will be analyzed off-line and in order to derive different ergonomics measures and skills measures. The main component of the system is represented by the instrument marker; this marker provides the position and orientation of the instrument with respect to the camera. The marker is manufactured from clear acrylic covered in an aluminum tape with a helical marker pattern cut out. Infrared LEDs are fitted into the ends so that a helical shape with two rings at either end is illuminated. A custom image processing algorithm that provides the position and orientation of the marker using the stereoscopic images was designed and implemented. Preliminary tracking tests use a marker mounted on a robot manipulator to compare the trajectories of the robot end-effector and the stereoscopic processing.

Results: The system is capable to track six markers simultaneously. Two instrument markers and four other round markers which can be placed on elbows and wrists. The tests for the instrument markers showed that at a distance of 0.68m from the stereoscopic camera, the camera recorded trajectory differed to that of the robot by a maximum of 1.5mm and with ~1mm root-mean-square (RMS) error. Tests repeated at a camera distance of 0.5m and 1.0m show maximum RMS errors of approximately 0.61mm and 2.4mm, respectively.

Conclusion: The trajectory tracking showed millimeter accuracies at reasonable distances from the camera. From this we conclude that we will be able to track both instruments in the cameras field of view with a desirable level of precision. The accuracy of the marker orientation still needs to be analyzed in greater detail.

Acknowledgement: The project described was partially supported by St. Joseph Hospital Surgical Associates Clinical Research Grant, NSERC and CFI.

Figure: Markers attached to laparoscopic instruments
ABSTRACT 56

PRE-BENT INSTRUMENTS FOR LAPAROENDOSCOPIC SINGLE-SITE SURGERY (LESS): ASSESSMENT FOR LESS NEPHRECTOMY

Estevão Lima1, Riccardo Autorino2,3, Fernando J. Kim4, Abhay Rane5, Marco De Sio3, Salvatore Micali6, Jihad H. Kaouk2 and Jorge Correia-Pinto1

1Life and Health Sciences Research Institute, School of Health Sciences, University of Minho, Braga, Portugal; 2Glickman Urological and Kidney Institute, Cleveland Clinic, Cleveland, OH, USA; 3Urology Clinic, Second University of Naples, Napoli, Italy; 4Division of Urology, Denver Health Medical Center and University of Colorado Health Sciences Center, Denver, Colorado, USA; 5Department of Urology, East Surrey Hospital, Redhill, United Kingdom; 6Dept. of Urology, University of Modena & Reggio Emilia, Modena, Italy

Introduction. Aim of this study is to assess feasibility of performing LESS Nephrectomy in porcine model using pre-bent laparoscopic instruments designed for general surgery LESS procedures.

Methods: Three experienced laparoscopic surgeons (FK, JHK, AR) with previous clinical experience in LESS performed 12 nephrectomies in 4 domestic female pigs. For all the procedures a multichannel access device and a 5 mm HOPKINS II long telescope were used. Four different sets of pre-bent instruments with different profiles (S-portal series, Karl Storz, Tuttlingen, Germany) were used (Figure 1): the standard (one straight scissors and one curved grasper), the Cuschieri set, the Carus set and the Leroy set (all of them consisting of two curved instruments). Three procedures were performed by using each of them. A performance assessment was done based on both objective (ie. overall procedure time; time to manage the pedicle; time to completely free the kidney) and subjective parameters (ie. entry/exit of the instruments; triangulation; dissection up/down; dissection lateral; retraction; interdependence). The assessment tool used for subjective parameters was a Likert type scale (1=easy to 5=prohibitive).

Results: The procedure were successfully completed in 10/12 cases (83%). Mean operative time was 8.3 minutes (range 3-16), being lower for the Carus group (4.5 min) and higher for the standard group (13 min). Mean time to manage the renal pedicle was 4.2 minutes (range 2-10). There was one complication (bowel injury during instrument insertion). Significant external clashing was noted in 41% of cases. Mean scores for each assessed parameter are summarized in the Table:

<table>
<thead>
<tr>
<th>Set</th>
<th>Exit-entry</th>
<th>Triangulation</th>
<th>Retraction</th>
<th>Dissection up/down</th>
<th>Dissection lateral</th>
<th>Interdependence</th>
<th>Overall score (5 to 30)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>1.3</td>
<td>1.3</td>
<td>1.3</td>
<td>1.6</td>
<td>2.3</td>
<td>1.6</td>
<td>9.6</td>
</tr>
<tr>
<td>Cuschieri</td>
<td>2.6</td>
<td>3.3</td>
<td>3</td>
<td>2.6</td>
<td>3.3</td>
<td>3.3</td>
<td>18.3</td>
</tr>
<tr>
<td>Carus</td>
<td>3</td>
<td>3.6</td>
<td>3.3</td>
<td>3.3</td>
<td>3.6</td>
<td>2.3</td>
<td>19.3</td>
</tr>
<tr>
<td>Leroy</td>
<td>4</td>
<td>2.6</td>
<td>2</td>
<td>2</td>
<td>2.3</td>
<td>3</td>
<td>16</td>
</tr>
</tbody>
</table>

Conclusion: Pre-bent instruments might represent attractive low-cost tools for LESS. The standard set allowed surgeons to perform LESS nephrectomies more easily compared to other sets of instruments. LESS urological instruments would be designed to allow further development of this surgical modality.
NEXT-GENERATION NITINOL STONE BASKETS: RADIAL DILATION FORCE AND DYNAMICS OF OPENING

Emily Korman, Kari Hendlin, Manoj Monga
University of Minnesota

Introduction: To evaluate radial dilation force and basket opening dynamics of three new ≤1.5Fr stone baskets.

Methods: Boston Scientific Optiflex™ (1.3 Fr), Cook N-Circle (1.5 Fr), and Sacred Heart Medical Halo (1.5 Fr) baskets were tested for radial dilation force (10 repetitions) using a Teflon block atop a digital scale that measured downward force as the baskets were deployed within a cylindrical opening. Opening dynamics were tested in triplicate, measuring changes in basket width with 0.5mm increments in opening length using a mechanical caliper under optical light microscopy to evaluate the linearity of basket opening and length at which target basket width (5 mm) was reached.

Results: The Halo had the best radial dilation (2.97± 0.22 g), compared to the N-Circle (1.29± 0.04 g), and Optiflex (1.19± 0.12 g). Each basket demonstrated unique opening dynamics; linear (N-Circle), polynomial (Optiflex) and exponential (Halo). The Halo took longer to reach the target basket width at a basket length of 11.5 mm, compared to the N-Circle (9.4mm) and Optiflex (9.6mm).

Conclusion: The baskets differ in characteristics that may impact basket opening in the face of ureteral edema (radial dilation force), control of deployment (linear vs. exponential), and maintenance of the basket within the field of view (length to reach target basket width).
Introduction: To discuss the evolution of laparoscopic partial nephrectomy (LPN) in 5 different techniques employed by our team.

Methods: From September 1999 until June 2008, we have performed 1000 LPN procedures. Standard LPN was applied in 820 cases. In this technique, renal parenchyma and collecting system reconstruction and hemostasia are performed with a clamped renal hilum. In 2006, a new early unclamping technique was introduced. In this contemporary technique, the renal hilum is unclamped after the first line of suture is applied to the partial nephrectomy excision bed. Robotics have also been applied to partial nephrectomy. So far, thirty-five cases have been performed robotically. In a pilot clinical trial, a special robotic instrument for the da Vinci System was developed and KTP laser was used to excise renal tumors leaving the renal hilum unclamped. Recently, 10 LPN were successfully performed through a novel multi-channel single port device.

Results: Standard LPN technique was applied in 820 patients. Mean tumor size was 2.7 cm. Mean operative time, mean warm ischemia time (WIT) and estimated blood loss (EBL) were 204 min, 30 min, and 258 mL, respectively. The early unclamping technique was used in 180 patients. Mean tumor size was 3.1 cm. Mean OR time and WIT were 220 min and 14 min, respectively. EBL was 346 mL. Robotic partial nephrectomy was performed in 35 patients. Mean tumor size was 3 cm. Mean OR time and WIT were 215 min and 14 min, respectively. EBL was 300mL. In 5 cases where KTP laser was used, mean tumor size was 1.8 cm. Mean OR time was 310 min and EBL 400 ml. The hilum was left unclamped in all but 1 case. In the single-port LPN group, mean tumor size was 3 cm. Mean OR time and WIT were, respectively, 270 min and 20 min. EBL was 150 mL. Surgical navigation and augmented reality during LPN are still under development.

Conclusions: Over the years, our technique of LPN has changed and new technologies have been, and will be, employed continuously.
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MATCHED PAIR ANALYSIS OF THE MEDSTONE STS AND STORZ MODULITH SHOCKWAVE LITHOTRIPTERS

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University of Minnesota

Introduction: We compared the results of shock wave lithotripsy (SWL) with a newer electromagnetic lithotripter to those of an electrohydraulic lithotripter using identical treatment and follow-up criteria.

Methods: We conducted a case-matched comparison of 8565 patients treated from 2003 to 2007 using the Medstone STS and Storz modulith SLX machines, matching for stone size, location, and patient body-mass index (BMI) with treatment success in producing stone-free status as the outcome of interest. Treatment characteristics, such as stone location and size, gating, and final success rate, were reported. P value < 0.05 was considered significant.

Results: Overall, the success rate for the Storz Modulith (61.1%) was equivalent to that achieved with Medstone STS (64.5%) (P=0.0664). The results of the matching and logistic regression showed that differences in stone-free rates were insignificant for all stones (P > 0.7592), lower pole kidney stones (P=0.9659), and ureteral stones (P=0.6409). Medstone STS performed better than Storz only for distal ureteral stones (83.63% vs 66.67%, P=0.0154). The rate of post SWL secondary procedures was equivalent (P=0.2079). The difference was insignificant (P=0.2988) for harder stones.

Conclusions: SWL treatment is equally effective using Medstone STS and STORZ modulith machines for different stone sizes and most stone locations. SWL treatment is more successful for lower ureteral stones using the Medstone STS machine. To our knowledge, this is the first study comparing these two commonly used lithotripters.
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ASSESSMENT OF A NOVEL DISSECTING SUCTION IRRIGATOR INSTRUMENT

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Introduction: Many surgeons favor laparoscopic Kittners for blunt dissection, as the gauze tip is comparatively atraumatic and allows effective soft tissue dissection. The laparoscopic suction irrigator also is used by surgeons for blunt dissection and retraction. We compare a standard suction irrigator to a novel combination suction irrigator / durable tip Kittner.

Methods: Two prototype devices and a standard suction irrigator were evaluated by seven surgeons. These prototype devices had Kittner ends and were separate tips that could be inserted in a standard Stryker irrigator. Device A had a small hole drilled in the tip of the device with the standard side holes covered. Device B had the standard side holes in the Stryker irrigator intact with a porous Kittner end. These were compared to Device C, a standard Stryker laparoscopic suction irrigator. We determined saline irrigation flow rates, and the three devices were assessed for aspiration, device properties (clogging, ease of cleaning, rigidity), dissection, and hemostasis, using a 10 point analog scale. Statistical analysis (unpaired t test and 2 way ANOVA) was done using Graph Pad Prism.

Results: Suction irrigator devices A, B, and C had saline flow rates of 4.4, 6.0 and 13.5 mL/sec. Devices A and B (modified suction irrigator tips) were appraised as slightly better than Device C (standard suction irrigator) in hilar dissection and hemostasis. Both modified instruments clogged more easily and were not as efficient at aspirating blood clots. The highest total point evaluation was received by Device A. Overall, there was no statistical difference between the three devices, but Devices A and B (modified suction irrigators) were rated significantly better in dissection and hemostasis (p <0.05).

Conclusion: The combination suction irrigator durable tip Kittner satisfies its dual roles: irrigation/aspiration and tissue dissection/hemostatic retraction. Clinical evaluation is pending.
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BEST PAPER AWARD

MICRO-PATTERNED SURFACES FOR THE REDUCING THE RISK OF CATHETER-ASSOCIATED UTI

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Introduction: The current paradigm for device-related strategies to prevent catheter-associated urinary tract infection (CAUTI) has been to introduce antimicrobial agents impregnated in the catheter material. However, use of antimicrobial agents can lead to resistance patterns that make infections more difficult to treat. This study presents a unique non-kill, physical surface modification approach for inhibiting bacterial biofilm formation. The unique Sharklet™ micro-pattern is a biomimetic topography modeled after the antifouling texture of shark skin. The surface has demonstrated reduced colonization compared to un-patterned surfaces for several species of microorganisms for in vitro testing. The aim of this study was to prove the use of the Sharklet micro-pattern for a novel Foley catheter application. Three variations of the Sharklet micro-pattern were tested for the ability to inhibit colonization of a uropathogenic strain of Escherichia coli (ATCC 70336) in either tryptic soy broth (TSB) or artificial urine (AU) growth media. Bacterial colonization was analyzed using viable plate counts and scanning electron microscopy (SEM).

Methods: Coupons (12mm diameter) with and without the Sharklet micro-pattern were fabricated in silicone elastomer. Patterned samples were created by casting the silicone elastomer against a micro-patterned silicon wafer mold. Coupons were placed into Petri dishes and gas sterilized with ethylene oxide prior to bacterial exposure. Growth media was inoculated with ~10⁶ CFU/mL E. coli and added to the dish. Dishes were incubated at 37°C for up to seven days with daily replenishing of growth media. Samples were recovered at 24 hours, 4 days and 7 days. Recovered coupons were rinsed in sterile 0.85% sodium chloride solution (NaCl) to remove non-adherent cells and then placed into conical tubes containing sterile NaCl for sonication and vortexing to recover and disaggregate attached colonies from the surfaces. The recovered cell suspensions were serially diluted and plated for enumeration. An extra set of coupons was prepared for SEM by exposure to osmium tetroxide vapor and an ethanol dehydration series. SEM micrographs were then analyzed for area coverage using Image J software.

Results: All three types of Sharklet micro-pattern inhibited biofilm formation in both TSB and AU (Figure 1). The reduction in E. coli area coverage ranged from 38% to 58%. The positive Sharklet pattern with protruding features (SK) and the inverse Sharklet pattern with recessed grooves (ISK) were most efficient at preventing aggregation of bacteria. Sharklet micro-patterns also caused a reduction in colony size of E. coli aggregates.

Conclusion: Three variations of the Sharklet micro-pattern demonstrated the ability to inhibit colonization of a uropathogenic E. coli in favored growth conditions through the use of physical surface modification alone. The results of this study suggest that physical surface modification of existing silicone Foley catheters with the Sharklet micro-pattern may prevent bacterial colonization, with implications for reduced rate of bacteriuria and incidence of CAUTI.
ABSTRACT 62

REUSABLE ACCESS DEVICE FOR LAPARO-ENDOSCOPIC SINGLE SITE SURGERY (LESS): ASSESSMENT IN PORCINE MODEL

Estevão Lima¹, Riccardo Autorino²³, Fernando J. Kim⁴, Abhay Rane⁵, Marco De Sio⁶, Salvatore Micale⁶, Jihad H. Kaouk² and Jorge Correia-Pinto¹

¹Life and Health Sciences Research Institute, School of Health Sciences, University of Minho, Braga, Portugal; ²Glickman Urological and Kidney Institute, Cleveland Clinic, Cleveland, OH, USA; ³Urology Clinic, Second University of Naples, Napoli, Italy; ⁴Division of Urology, Denver Health Medical Center and University of Colorado Health Sciences Center, Denver, Colorado, USA; ⁵Department of Urology, East Surrey Hospital, Redhill, United Kingdom; ⁶Dept. of Urology, University of Modena & Reggio Emilia, Modena, Italy

Introduction: Aim of this study is to describe and assess a new re-usable access device for single port laparoscopy (Figure 1).

Methods: Three experienced laparoscopic surgeons (FK, JHK, AR) with previous clinical experience with LESS (> 20 cases performed) used a multichannel access device (X-CONE™, Karl Storz, Tuttlingen, Germany) to perform 12 nephrectomies (6 right and 6 left) in 4 domestic female pigs. For all the procedures a 5 mm HOPKINS II long telescope with HD-compatibility and pre-bent instruments with different profiles (S-portal series, Karl Storz, Tuttlingen, Germany) were used. At the end of each procedure, the performance of the device was assessed based on objective (time to complete insertion) and subjective parameters (ie. significant leaking, movement constraint). Complications were also recorded.

Results: To insert the X-CONE™, a mini-laparotomy is performed (approximately 1 cm long incision in the pig). Afterward, the atraumatic X-CONE halves are successively inserted in a similar manner as retractors and joined to form a sealing cone using a pivoting movement. Then, the seal is snapped on. Time required completing insertion and starting CO₂ insufflation was less than 1 minute in all the cases. Surgeons reported a significant leaking in 58% of the cases, even if this problem was overcome by using a tourniquet. A high movement constraint was reported in 50% of the cases. There were no complications related to port insertion. The X-CONE seal allowed a flexible use of the different instruments with variable configuration.

Conclusion: X-CONE™ represents the first reusable access device for single-port surgery allowing surgeons to have easy access to the intraperitoneal cavity to perform LESS. The reusable properties of this access device may represent cost savings for LESS compared to disposable devices. Further clinical assessment is warranted.

Figure 1. The X-CONE (Karl Storz Endoskope, Tuttlingen, Germany)
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LONG-TERM RESULTS FOLLOWING HIFU TREATMENT OF PATIENTS WITH LOCALLY ADVANCED PROSTATE CANCER

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INTRODUCTION AND OBJECTIVES: The efficacy of local therapy (TURP + HIFU) in patients with locally advanced prostate cancer was followed up to 9 years.

METHODS: A subgroup analysis was extracted out of the prospective Munich HIFU database. Efficacy and side effects of the HIFU treatment were obtained from 113 patients (mean age 69, range 49-84) during a follow-up time from 1 to 9 years.

RESULTS: The median follow-up was 4.6 years (1.3 – 9); 92 % of the patients were staged as T3 and 8% as T4. Both groups showed no evidence of systemic disease. The median PSA was 16.5 ng/mL (0.6-211), whereby 6% were < 10 ng/mL and 15% >40 ng/mL. Median Gleason was 7 (4 – 10), median PSA at treatment 7.8 ng/mL (0.6-131). 58% of the patients had no hormonal ablation at all, 38% < 3 months, none > 6 months before treatment. Adjuvant permanent hormonal ablation during follow up was only 4.4%. Median PSA Nadir: 0.2ng/mL (0-10.5), time to Nadir (months): 2.8 (0.8-9.3). Median last PSA 1.1ng/mL (0-447), including 82% < 10ng/mL and 7% > 40 ng/mL. Follow-up time (months): 56(15-108). PSA velocity median 0.19 ng/mL/year. Deaths in follow up: 16/133 (12%) 4 PCa related, 6 not PCa related, 6 unknown reason. Postoperative side effects: 5% Clavien 1-3, 21% intermittent micturition problems and 15% urinary tract infections. PSA was still 93 % below initial PSA levels after a median follow-up of 5 years.

CONCLUSIONS: The concept of minimal non-invasive tumor ablation with HIFU in locally advanced PCa showed favorable results.
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BIOIMPEDANCE BODY COMPOSITION ANALYSIS PREDICTS HISTOPATHOLOGY OF SMALL RENAL CORTICAL NEOPLASMS

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Introduction: Mounting evidence has demonstrated that obesity metrics correlate with oncologic parameters. Bioimpedance spectroscopy (BIS) is a relatively new technology that can very precisely quantify body composition (BC). Predicting malignancy of renal cortical neoplasms (RCN) in a non-invasive manner would diminish surgery for benign lesions. As such, we evaluated preoperative bioimpedance BC prospectively in patients undergoing renal surgery for RCN.

Methods: We prospectively evaluated patients undergoing minimally invasive renal procedures for RCN with the Imp SFB7 device. Between December 2008 and March 2010, 67 patients underwent preoperative BIS BC analysis. Fat mass (FM), percentage fat mass (PFM), fat-free mass (FFM), and percentage fat-free mass (PFFM) were obtained. We performed a multiple linear regression analysis to evaluate whether these parameters could predict malignant histopathology of RCN.

Results: The mean patient weight and height were 184.9 lb (range 116-292) and 66.1 inches (range 52-78), respectively. Average tumor size was 3.7 cm (1.2-8.8). Histopathology revealed 44 (65.7%) conventional renal cell carcinomas (RCC), 5 (7.5%) chromophobe RCC, 5 (7.5%) papillary RCC, and 13 (19.4%) benign lesions. The mean FM, %FM, FFM and %FFM for malignant and benign RCN were 55.2lbs, 29.8%, 131.9lbs, 70.2%, and 46.6lbs, 24.9%, 133.9lbs, 75.0%, respectively. After controlling for age, gender, and body mass index, regression analysis revealed that there was no significant association between the body composition parameters and malignancy (FM- p=0.3316, %FM- p=0.2143, FFM- p=0.5440, %FFM- p=0.2143).

Conclusions: In this preliminary evaluation bioimpedance spectroscopy quantified body composition does not predict for malignancy in renal tumors. Further investigation is currently in progress to determine the value of body composition related to kidney cancer.
ABSTRACTS

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UROLOGIC LAPAROENDOSCOPIC SINGLE-SITE SURGERY USING A HOMEMADE SINGLE PORT DEVICE: A SINGLE CENTER EXPERIENCE OF 68 CASES

Woong Kyu Han, Jae Won Lee, Won Sik Ham, Francis P. Aroncel, Ho Song Yu, Kyung Hwa Choi, Yunbyung Chae, Koon Ho Rha

Department of Urology, Urological Science Institute, Yonsei University College of Medicine, Seoul, Korea

Introduction: We present experience of a single center in the application of the laparoendoscopic single-site surgery using a homemade single port device in urologic surgery.

Methods: Between December 2008 and February 2010, 68 consecutive laparoendoscopic single-site urologic surgeries were performed by three surgeons in our institution. All procedures were performed using a homemade single port device made with the Alexis® wound retractor fitted with a standard surgical glove hand. A 4 cm long incision was made over the umbilicus. After the inner ring of the wound retractor was placed into the peritoneum, the operator folded the outer ring of wound retractor three times. Sutures were placed and the outer ring of the wound retractor was folded again two or three times to prevent air leak from the sutures and hold the wound retractor snug against the abdominal wall. A homemade single port was established by inserting 3 or 4 trocars through fingers of a surgical glove and securing it to the port with a tie and a rubber band. Data were analyzed, including patients’ characteristics, operative records, and complications.

Results: A total of 68 laparoendoscopic single-site urologic surgeries were performed during the study period.

Table 1. Procedures, surgical indication or diagnosis, and perioperative results of laparoendoscopic single site surgery

<table>
<thead>
<tr>
<th>Procedures</th>
<th>Surgical indication or diagnosis</th>
<th>Mean Size (cm)</th>
<th>Mean OR time (min)</th>
<th>Mean EBL (ml)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radical nephrectomy</td>
<td>Renal cell carcinoma (16)</td>
<td>5.1</td>
<td>222</td>
<td>317</td>
<td>Diaphragm injury (2)</td>
</tr>
<tr>
<td>(n=19)</td>
<td>Urothelial carcinoma, pelvis (1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ewing sarcoma (1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cyst decortication</td>
<td>Mixed epithelial and stromal tumor (1)</td>
<td>5.6</td>
<td>101</td>
<td>28</td>
<td></td>
</tr>
<tr>
<td>(n=16)</td>
<td>Transperitoneal (13)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Retropertitoneal (3)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Simple nephrectomy</td>
<td>Nonfunctioning kidney (13)</td>
<td>-</td>
<td>234</td>
<td>422</td>
<td>IVC injury and mini-incipisional open conversion (1), ileus (1)</td>
</tr>
<tr>
<td>(n=13)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ureterolithotomy</td>
<td>Stone (5)</td>
<td>5.6</td>
<td>273</td>
<td>170</td>
<td></td>
</tr>
<tr>
<td>(n=5)</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Partial nephrectomy</td>
<td>Renal cell carcinoma (1)</td>
<td>2.5</td>
<td>226</td>
<td>70</td>
<td>Margin positive (0)</td>
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<tr>
<td>(n=3)</td>
<td>Angiomyolipoma (1)</td>
<td></td>
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<td>Bowel injury (1)</td>
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<tr>
<td></td>
<td>Metanephric adenoma in a child (1)</td>
<td></td>
<td></td>
<td></td>
<td>Mini-incipisional open conversion (1)</td>
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<tr>
<td>Nephroureterectomy</td>
<td>Urothelial carcinoma (1)</td>
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<td>324</td>
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<td>Vesicoureteral reflux in a child (1)</td>
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<td>Ectopic ureter in a child (1)</td>
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<td>Pyeloplasty</td>
<td>Ureteropelvic junction obstruction (3)</td>
<td>-</td>
<td>207</td>
<td>87</td>
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<td>Partial cystectomy</td>
<td>Urachal remnant (2)</td>
<td>3.5</td>
<td>171</td>
<td>50</td>
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<td>Leiomyoma (1)</td>
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<td>Adrenalectomy</td>
<td>Pheochromocytoma (1)</td>
<td>5.7</td>
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<td>125</td>
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<tr>
<td>(n=2)</td>
<td>Leiomyosarcoma (1)</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Ureterectomy</td>
<td>Duplication of ureter (ectopic ureter)</td>
<td>-</td>
<td>129</td>
<td>150</td>
<td>Wound dehiscence (1)</td>
</tr>
<tr>
<td>(n=1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Abbreviation: OR, operating room; EBL, estimated blood loss; IVC, inferior vena cava

Conclusion: Laparoendoscopic single-site surgeries are feasible and can be applied safely to a variety of urologic operations. Our homemade single port device provides adequate range of motion and is more flexible in port placement for laparoendoscopic single site surgery than the current multichannel port.
ABSTRACT 66

INTRA-OPERATIVE EVALUATION OF RENAL BLOOD FLOW DURING LAPAROSCOPIC PARTIAL NEPHRECTOMY WITH A NOVEL DOPPLER SYSTEM

Adam C. Mues, Zhamshid Okhunov, Ketan Badani, Mantu Gupta, Jaime Landman
Columbia University, Department of Urology, New York, NY 10032

Introduction: Hemostasis remains a major challenge associated with laparoscopic renal surgery. We evaluated a cost-effective novel doppler probe (DP) for assessment of vascular control during laparoscopic partial nephrectomy (LPN).

Methods: We prospectively collected data during LPN procedures. We documented tumor location and size as well as subjective quality of the hilar dissection. The DP was compared with our standard intra-operative ultrasound system (SUS) for the capability to detect blood flow during hilar dissection and determine parenchymal ischemia around the tumor after clamping of the renal vessels.

Results: Twenty patients underwent LPN by a single surgeon. The mean tumor size was 3.0 cm (range 1.2 to 6.3 cm). The time to assess the kidney using the SUS was 68.6 seconds (range 20 to 155) versus 44.5 seconds (range 15 to 180) with the DP. Evaluation prior to renal hilar clamping demonstrated the presence of blood flow in 20/20 (100%) of patients using the SUS and 17/20 (85%) using the DP. Similarly, cessation of blood flow with clamping was documented in 100% of cases with SUS and 85% with DP. Persistent flow was detected by both SUS and DP in 2 patients requiring further dissection and re-clamping. Both systems then detected the absence of flow before tumor resection. With blood flow interruption confirmation, no patient had significant bleeding at the time of renal parenchymal transection.

Conclusions: Intra-operative Doppler ultrasound technologies minimize the risk of significant bleeding during laparoscopic partial nephrectomy. The DP is a small, simple, effective probe that can be used to assess blood flow interruption to the kidney during laparoscopic renal surgery.
ABSTRACT 67

ROBOTIC AND LAPAROSCOPIC RADICAL CYSTECTOMY WITH EXTENDED PELVIC LYMPHADENECTOMY

Andre Berger, Mihir M Desai, Monish Aron, Ricardo Brandina, Osamu Ukimura, Matthew Dunn, Anne Schukman, Heloisa Tezzoni Rofrigues, Eila Skinner, Inderbir S. Gill

USC Institute of Urology, Keck School of Medicine, University of Southern California, Los Angeles, California, USA

INTRODUCTION: Our purpose is to present the technical feasibility and report outcomes of extended pelvic lymph node dissection during robotic and laparoscopic radical cystectomy.

METHODS: Between January 2007 through September 2009, we performed extended pelvic lymph node dissection as defined as up to the inferior mesenteric artery (N=10) or aortic bifurcation (N=5) in 15 patients undergoing robotic (N=3) or laparoscopic (N=12) radical cystectomy. Mean age was 68 years, BMI was 27, and ASA class was >2 in 40% of the patients. There was 1 female (7%). All diversions were performed extracorporeally and included orthotopic pouch in 5 and ileal conduit in 10.

RESULTS: All procedures were technically successful without the need for conversion to open surgery.

<table>
<thead>
<tr>
<th></th>
<th>Mean, Median, (Range)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean operative time (min)</td>
<td>380 (240-720)</td>
</tr>
<tr>
<td>Estimated blood loss (cc)</td>
<td>642 (150-1250)</td>
</tr>
<tr>
<td>Complications</td>
<td>6 (MI, post-discharge DVT, ureteral stricture, abdominal fluid collection drained POD 17, small bowel obstruction, anastomotic leak requiring PCN)</td>
</tr>
<tr>
<td>No. positive margins</td>
<td>3 (CIS at ureteral margin 2, bladder margin 1)</td>
</tr>
<tr>
<td>Lymph node yield</td>
<td>36, 26 (15-78 )</td>
</tr>
<tr>
<td>Mean, median, (range)</td>
<td></td>
</tr>
<tr>
<td>No. Positive lymph nodes</td>
<td>2, 0 (0-23)</td>
</tr>
<tr>
<td>Mean, median, (range)</td>
<td></td>
</tr>
<tr>
<td>Mean followup (months)</td>
<td>13 (1-32)</td>
</tr>
<tr>
<td>No. Recurrence</td>
<td>0</td>
</tr>
</tbody>
</table>

CONCLUSIONS: Extended pelvic lymph node dissection during laparoscopic or robotic radical cystectomy is technically feasible. If so desired, nodal yield comparable to open surgery can be routinely achieved and should therefore not be considered a limitation of minimally invasive surgery.
ABSTRACTS

ABSTRACT 68

DOES BODY MASS INDEX (BMI) AFFECT THE CLINICAL OUTCOMES OF ROBOT-ASSISTED LAPAROSCOPIC PROSTATECTOMY (RALP)?

Kurt H Strom, Massimiliano Spaliviero, Xiao Gu, Carson Wong
University of Oklahoma Health Sciences Center

Introduction: With the 35% prevalence of obesity in the United States, a significant proportion of RALP candidates have an elevated BMI. We determine if this impacts surgical outcomes and morbidity of the procedure.

Methods: Consecutive patients who underwent transperitoneal RALP (anterior approach) by a single surgeon (CW) were reviewed. Clinical outcomes and adverse events were recorded prospectively and analyzed in obese (I; BMI>30kg/m²), overweight (II; BMI 25-30kg/m²) and normal weight (III; BMI<25kg/m²).

Results: 161 patients were identified-- I: 47 (29.1%); II: 81 (50.3%); and III: 33 (20.4%). The mean BMI were significantly different-- I: 32.8±2.7; II: 26.1±3.4; III: 23.1±1.6kg/m², (p<0.001). There were no significant statistical differences in mean age (I: 61.7±6.1; II: 62.2±9.8; III: 62.4±5.0 years), PSA (I: 5.5±4.1; II: 6.3±5.1; III: 6.1±3.2 ng/mL), incidence of bladder neck reconstruction [I: 0 (0.0%); II: 1 (1.2%); III: 0 (0.0%)], estimated blood loss (I: 103.1±50.0; II: 91.7±41.3; III: 79.2±23.4mL), prostate volume (I: 41.5±13.6; II: 42.4±12.1; III: 44.4±13.0mL), positive surgical margins [I: 9 (19.1%); II: 17 (20.9%); III: 3 (9.0%)], hospitalization (I: 1.1±0.6; II: 1.1±0.3; III: 1.5±2.2days) and time to continence without pads (I: 9.8±8.6; II: 9.7±7.8; III: 9.5±6.9weeks). The median urethral catheter duration was similar in all groups (5.0days). The operative time was shorter in group 3 compared to both groups 1 (I: 223.1±59.0 vs. III: 190.8±41.4 minutes, p=0.010) and 2 (II: 213.6±53.1 vs. III: 190.8±41.4 minutes, p=0.039). Adverse events included prolonged urine leak (>6days) [I: 2 (4.3%); II: 2 (2.4%); III: 1 (3.0%)], ileus [I: 0 (0.0%); II: 1 (1.7%); III: 0 (0.0%)], pelvic hematoma [I: 1 (2.1%); II: 0 (0.0%); III: 1 (3.0%)], fascial dehiscence [I: 1 (2.1%); II: 0 (0.0%); III: 0 (0.0%)], 1 urinary tract infection [I: 0 (0.0%); II: 2 (2.4%); III: 0 (0.0%)], transient acute renal failure [I: 0 (0.0%); II: 1 (1.2%); III: 1 (3.0%)], deep vein thrombosis [I: 0 (0.0%); II: 2 (2.4%); III: 0 (0.0%)] and bladder neck contracture [I: 2 (4.2%); II: 2 (2.4%); III: 1 (3.0%)], none of which were significantly different between the 3 groups.

Conclusion: Elevated BMI appears to increase the operative time, but has little impact on blood loss, duration of hospitalization, clinical outcomes or patient morbidity in patients undergoing RALP.
NORMAL SALINE, BIPOLAR RESECTION UTILIZING STANDARD RESECTOSCOPE SHEATHS AND ELECTROCAUTERY GENERATOR

Joseph V. DiTrollo, Rahuldev Bhalla, Patrick Ciccone, Michael D. LaSalle
St. Barnabas Medical Center, Livingston, NJ; New Jersey Medical School, Newark, NJ; Stony Brook University Medical Center, East Setouket, NY

INTRODUCTION: Normal saline bipolar resection or vaporization of the prostate has been a recent development with much promise. Unfortunately, the additional cost of replacing existing resectoscope sheaths and cautery generators has prevented this from becoming more widely used. This is the first test of Salinetrode™ vaporization electrode and resection loop.

METHODS: Patient scheduled for transurethral resection of his prostate was irrigated with normal saline and utilizing a 26Fr standard Storz continuous flow resectoscope sheath and bridge. The bipolar Saline Dome Electrode or the 24Fr Saline Bladder Loop produced by ProSurg were inserted into the resectoscope working element and connected to a Valleylab Force Fx™ Electrosurgical Generator set at 300 watts pure cut. The return was a modified ground electrode attached to the resectoscope sheath at the point of luer lock utilized for fluid irrigation.

RESULTS: Utilization of existing equipment with the specialized bipolar loops produced by ProSurg allowed for adequate vaporization or resection, depending on the electrode, with saline irrigation. Enhanced control of intraoperative bleeding and tissue vaporization were as expected in a bipolar format and no damage occurred to the existing scope, sheath or working element.

CONCLUSION: ProSurg Salinetrode™ system is a reasonable alternative for an inexpensive approach to bipolar saline irrigation, surgical vaporization or resection of prostatic tissue. Further evaluation is recommended.
ABSTRACTS

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HOLMIUM:YAG LITHOTRIPSY FRAGMENTATION VARIES WITH PULSE ENERGY

Lee Jonat, Ben Chew, Joel Teichman
University of British Columbia, Vancouver, BC

Introduction and Objective: The holmium:YAG laser fragments stones by photothermal mechanism. Increased pulse energy produces larger ablation craters, implying faster lithotripsy. However, increased pulse energy produces more retropulsion, implying slower lithotripsy. We studied optimal power settings for holmium:YAG lithotripsy.

Methods: Stone phantoms of uniform shape and mass were ablated in water with 500 J total energy (n=10 per cohort). Six power settings were tested: 0.2 J at 10 Hz, 0.2 J at 50 Hz, 0.5 J at 10 Hz, 0.5 J at 40 Hz, 1.0 J at 10 Hz, 2.0 J at 10 Hz. Two conditions were tested: no stabilization device versus placement of a PercSys Accordion stabilization device behind the stone. After lithotripsy, fragments were dried and passed through sequential geological sieves. To quantify fragment size distribution, we reported the % fragments > 1 mm of the top 10%ile largest fragments per cohort. Total fragmentation (TF) was defined as initial mass minus the dominant remaining mass. In the “no device” cohorts, retropulsion was measured. ANOVA, Kruskal-Wallis, Mann-Whitney and t-tests were used for statistics.

Results: TF, % mass of fragments > 1 mm, and retropulsion are shown in the Table:

<table>
<thead>
<tr>
<th>Power Setting</th>
<th>TF no device (g)</th>
<th>% &gt;1 mm, no device</th>
<th>Retropulsion (mm), no device</th>
<th>TF + device (g)</th>
<th>% &gt; 1 mm, + device</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.2 J 10 Hz</td>
<td>0.01 ± 0.00</td>
<td>0</td>
<td>26 ± 6</td>
<td>0.01 ± 0.01</td>
<td>0</td>
</tr>
<tr>
<td>0.2 J 40 Hz</td>
<td>0.02 ± 0.01</td>
<td>0</td>
<td>22 ± 5</td>
<td>0.03 ± 0.01</td>
<td>0</td>
</tr>
<tr>
<td>0.5J 10 Hz</td>
<td>0.04 ± 0.01</td>
<td>22</td>
<td>58 ± 15</td>
<td>0.05 ± 0.01</td>
<td>10</td>
</tr>
<tr>
<td>0.5J 40 Hz</td>
<td>0.02 ± 0.01</td>
<td>5</td>
<td>63 ± 9</td>
<td>0.05 ± 0.01</td>
<td>15</td>
</tr>
<tr>
<td>1.0 J</td>
<td>0.05 ± 0.01</td>
<td>4</td>
<td>98 ± 15</td>
<td>0.09 ± 0.03</td>
<td>37</td>
</tr>
<tr>
<td>2.0 J</td>
<td>0.05 ± 0.01</td>
<td>1</td>
<td>152 ± 38</td>
<td>0.14 ± 0.03</td>
<td>36</td>
</tr>
</tbody>
</table>

Comparing no stabilization vs. stabilization for each power cohort, TF increases with stabilization devices, except for 0.2 J 10 Hz and 0.5 J 10 Hz cohorts, p<0.01; fragment size increased with stabilization for 1.0 J and 2.0 J cohorts, p<0.0001.

Conclusions: When retropulsion is constrained by a stabilization device, increasing pulse energies produce more lithotripsy but also larger fragments. With no stabilization device, increasing pulse energies produce more retropulsion with less efficient lithotripsy. At low pulse energy, fragments are small but lithotripsy is less efficient. The optimal power settings appear to be low pulse energy (0.2 – 0.5 J) at high frequency (40 Hz), which produces an intermediate amount of lithotripsy without creating large fragments.
COMPLICATIONS OF STONE BASKETS: 14 YEARS OF THE MAUDE DATABASE

Ekkarin Chotikawanich, Emily Korman, Manoj Monga
University of Minnesota

Introduction: To categorize trends in failure of the stone baskets as reported in the U.S. Food and Drug Administration’s Manufacturer and User Facility Device Experience database (MAUDE).

Methods: We queried the MAUDE online database from January 1996 to December 2009, using the code for stone baskets (FFL). Variables extracted included type of basket, type of malfunction, type of treatment, and patient outcome.

Results: 556 adverse events related to the use of stone baskets were identified. Device configurations consisted of tipped (48%), tipless (36%), forceps (8%), and stone-cone (8%). Type of malfunctions reported included detachment of a portion of the basket (49%), breakage without detachment (39%), and inability to withdraw the basket (12%). Compared to the early time period studied (1996-2004), there was a 3x increase in adverse events from 2005-2007, and a 6x increase in adverse events from 2008-2009. The majority of adverse events were managed with endoscopy (79%) and open surgery (11%). 42 patients experienced serious complications, with major surgeries including ureteral reconstruction (7), reimplantation (4) and nephrectomy (7).

Conclusion: With increased utilization of stone baskets in the upper collecting system, the number of adverse events has increased. Urologists should remain vigilant in the prevention, recognition, and management of these events.
ABSTRACT 72

HOLMIUM:YAG LASER LITHOTRIPSY AT HIGH PULSE ENERGIES VERSUS THULIUM FIBER LASER LITHOTRIPSY AT HIGH PULSE RATES

Richard L. Blackmon1, Pierce B. Irby2, and Nathaniel M. Fried1,3

1Department of Physics and Optical Science, University of North Carolina, Charlotte, NC
2McKay Department of Urology, Carolinas Medical Center, Charlotte, NC
3Department of Urology, Johns Hopkins Medical Institutions, Baltimore, MD

Introduction: The clinical flashlamp-pumped Holmium:YAG laser is capable of operating at high pulse energies, but is limited to operation at low pulse rates during lithotripsy. On the contrary, the experimental diode-pumped Thulium fiber laser is limited to low pulse energies, but it is capable of operating at high pulse rates. This study compares the two different operation parameters of the Holmium and Thulium fiber lasers to determine which operation mode is more efficient for lithotripsy.

Methods: A Thulium fiber laser (λ = 1908 nm) was operated with a pulse energy of 35 mJ, pulse duration of 500 µs, and pulse rates of 10-100 Hz. A clinical Holmium laser (λ = 2120 nm) was operated with pulse energies of 30-1000 mJ, pulse duration of 350 µs, and pulse rate of 10 Hz. Handheld, small-core, silica optical fibers (200-µm or 270-µm) delivered the laser radiation to human calcium oxalate monohydrate (COM) stones submerged and held fixed in a saline bath. After 6000 pulses, stone mass loss was measured, and average stone vaporization efficiency (µg/J) and rate (µg/s) were calculated.

Results: At low pulse energies of 30-35 mJ and pulse rates of 10 Hz, the Thulium fiber laser is approximately 10 times more efficient and faster for vaporization of COM stones than the Holmium laser (Table 1). As the Holmium laser pulse energy was increased, both the stone vaporization efficiency and rate increased significantly as well. As the Thulium fiber laser pulse rate was increased from 10 to 100 Hz, the stone vaporization efficiency steadily decreased, possibly due to absorption of a higher number of laser pulses in the saline bath as the fiber was moved across the stone, although this effect requires further study. Charring of the stone surface was also observed at Thulium fiber laser pulse rates above 100 Hz. However, in a clinical environment with constant saline irrigation and cooling of the stone surface, Thulium fiber laser operation at pulse rates up to 1000 Hz may be feasible and warrants further study, along with a comparison of stone retropulsion effects at high Holmium laser pulse energies and high Thulium fiber laser pulse rates.

Conclusion: Holmium laser lithotripsy at high pulse energies provides greater stone vaporization efficiencies and rates than Thulium fiber laser lithotripsy at low pulse energies and high pulse rates. However, these preliminary results provide motivation for further development of the Thulium fiber laser, with operation at higher pulse rates (e.g. up to 1000 Hz) and/or higher pulse energies (> 35 mJ).

Table 1. Comparison of COM stone vaporization efficiency (µg/J) and rate (µg/s) for Holmium and Thulium fiber lasers.

<table>
<thead>
<tr>
<th>Pulse Energy (mJ)</th>
<th>Holmium Laser (10 Hz)</th>
<th></th>
<th></th>
<th></th>
<th>Thulium Fiber Laser (35 mJ)</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Efficiency (µg/J)</td>
<td>Rate (µg/s)</td>
<td>N</td>
<td></td>
<td>Efficiency (µg/J)</td>
<td>Rate (µg/s)</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>7 ± 5</td>
<td>2 ± 1</td>
<td>5</td>
<td>10</td>
<td>77 ± 6</td>
<td>28 ± 2</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>60</td>
<td>41 ± 9</td>
<td>24 ± 5</td>
<td>5</td>
<td>30</td>
<td>63 ± 6</td>
<td>66 ± 6</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>115</td>
<td>51 ± 3</td>
<td>59 ± 4</td>
<td>5</td>
<td>50</td>
<td>47 ± 6</td>
<td>85 ± 10</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>165</td>
<td>62 ± 10</td>
<td>102 ± 16</td>
<td>5</td>
<td>100</td>
<td>40 ± 10</td>
<td>140 ± 40</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>690*</td>
<td>139 ± 21</td>
<td>953 ± 160</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1010*</td>
<td>170 ± 41</td>
<td>1727 ± 485</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*A 270-µm optical fiber was used with the Holmium laser at the highest pulse energy settings to avoid damage to the input connector of the fiber from potential laser-fiber mismatch. All other studies were performed with a 200-µm fiber.
ABSTRACT 73

DA VINCI PARTIAL NEPHRECTOMY: IS USE OF A LAPAROSCOPIC SATINSKY CLAMP SAFE AND EFFECTIVE FOR HILAR CONTROL?

Rakesh Khanna, Sylvain Forest, Riccardo Autorino, Bo Yang, Michael A. White, Fatih Altunrende, Georges-Pascal Haber, Gaurang Shah, Jihad H. Kaouk, Robert J. Stein  
Center For Laparoscopic and Robotic Surgery, Glickman Urological and Kidney Institute, Cleveland Clinic, Cleveland, OH

Objectives: With growing clinical experience with the da Vinci robotic system (Intuitive Surgical, Sunnyvale, CA) and the dissemination of techniques for its use in nephron-sparing surgery, robotic partial nephrectomy has become increasingly popular as a minimally invasive option. Use of a laparoscopic Satinsky clamp has been used commonly for hilar control in pure laparoscopic partial nephrectomy but seems to be less popular for the da Vinci procedure, perhaps due to concerns of external collision with the robotic arms and lack of direct surgeon control. We review our experience with use of the Laparoscopic Satinsky clamp in da Vinci partial nephrectomy in order to determine its safety and efficacy for this procedure.

Methods: A 5-port approach was used for left-sided procedures and a 6-port approach on the right. Prior to cinching of the Satinsky clamp from the lower midline port site, a brief simulation of the partial nephrectomy was performed to assess for any external collision of the robot and the clamp. If no collision was noted, the lower midline port-site was used for clamping. If there was collision, a pre-existing port site between the camera and more cranial robotic arm was used to introduce the clamp.

Results: From 1/1/2009 to the present, 27 da Vinci partial nephrectomy procedures were performed by a single surgical team. A Laparoscopic Satinsky clamp was successfully used in 26 of the procedures (96.3%) and laparoscopic bulldog clamps were used in 1 procedure due to inability to place an ancillary trocar in the pelvis as a result of extensive prior surgery. Multiple renal arteries were present in 5 procedures (18.5%) and multiple renal veins in 2 procedures (7.4%). Adequate vascular control during resection was noted in all cases and no obvious vascular injuries occurred in any case. No complications related to clamping occurred, and 1 transfusion was given intraoperatively for low starting hematocrit. For the series, mean tumor size was 3.0cm, mean estimated blood loss was 279.2cc, mean operative time was 235.4 min., and mean warm ischemia time was 20.7 min. In all cases, the parenchymal margin was negative for tumor involvement.

Conclusions: Reliable vascular control is of crucial concern during nephron sparing surgery. Based on our preliminary experience, use of a Laparoscopic Satinsky clamp during da Vinci partial nephrectomy is safe, dependable and provides excellent hilar compression.
ABSTRACT 75

OUTSTANDING PAPER AWARD

DYNAMIC REAL TIME MICROSCOPY OF THE URINARY TRACT: AN IMAGING ATLAS-BASED ON CONFOCAL LASER ENDOMICROSCOPY

Katherine Wu\textsuperscript{2}, Winifred Adams\textsuperscript{1,2}, Geoffrey Sonn\textsuperscript{1,2}, Kristin Jensen\textsuperscript{2}, Joseph C. Liao\textsuperscript{1,2}

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\textsuperscript{2}Veterans Affairs Palo Alto Healthcare System, Palo Alto, California

Introduction: Probe-based confocal laser endomicroscopy (pCLE) is a promising new technology for dynamic, \textit{in vivo} imaging of the endoluminal tracts with micron-scale resolution. Based on the well-established principle of confocal microscopy, pCLE utilizes miniaturized fiberoptic imaging probes inserted in standard medical endoscopes to obtain real time histopathology, or ‘optical biopsy’. We recently reported initial \textit{in vivo} feasibility study of pCLE of the urinary tract. Here we provide an in depth characterization of the confocal images acquired from benign and neoplastic landmarks of the lower urinary tract. We utilized post-hoc image processing feature called “mosaicing” to juxtapose individual image frames into a wider angle view of the area of interest to better evaluate the microarchitecture. We have compiled representative images into an atlas with the goal to establish diagnostic imaging criteria to impact future therapeutic decision making based on pCLE.

Methods: With IRB approval, patients scheduled for cystoscopic biopsy or transurethral resection of bladder tumors (TURBTs) were recruited. The Cellvizio pCLE system (Mauna Kea Technologies, Paris, France) was used. Following white light cystoscopy (WLC), intravesical or intravenous fluorescein was administered as previously described. Image acquisition was performed through contact between the probe and the area of interest and subsequently compared with standard hematoxylin and eosin (H&E) analysis by pathology.

Results: Confocal images of normal regions of the lower urinary tract have been obtained and characterized, including the bladder urothelium (superficial umbrella cells, intermediate cells, and lamina propria), prostatic urethra, and penile urethra. In contrast to the organized network of cells found in normal tissue, neoplasia (low grade, high grade, and carcinoma \textit{in situ}) is characterized by features such as neoangiogenesis, variations in cellular morphology, and distortion of the microarchitecture. Benign regions including TURBT resection bed (muscularis propria, perivesical fat), necrosis, denuded mucosa, cystitis, and post-BCG inflammation have also been imaged and characterized. Image processing with the mosaicing feature was helpful to expand the confocal field of view.

Conclusion: In contrast to standard pathological analysis of fixed tissue with H&E, pCLE provides real time microscopy of the urinary tract to enable dynamic interrogation of the vascularized benign and neoplastic tissues. We have identified key features associated with each of the different anatomic landmarks. The confocal atlas will facilitate adaptation of pCLE to be used in conjunction with WLC to expedite diagnosis urinary tract pathology, particularly bladder cancer.
ABSTRACT 76

INSTRUMENTAL TRIANGULATION DETERMINE THE EFFICACY OF THE “SPIDER” LESS DEVICE FOR LAPROSCOPIC RENAL SURGERY

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1 Joint Bioengineering and Endourology Developmental Surgical (JBEDS) Laboratory
Division of Endourology, Laparoscopy, and Minimally-Invasive Surgery, Department of Urology, University of Miami Miller School of Medicine, Miami, FL, USA,
2 Department of Biomedical Engineering, University of Miami, Coral Gables, FL, USA

Introduction: Laparo-endoscopic Single Site (LESS) surgical procedures have theoretical advantages over other laparoscopic procedures in which only one port is required. However, the ergonomics behind this procedure is cumbersome with loss of triangulation, counterintuitive movements, crossing of instruments and clashing. The SPIDER (Single Port Instrument Delivery Extended Reach) system (Trans-enterex, Durham, NC) is a single port laparoscopic system that allows single port triangulation within the abdominal cavity. Through the single port, there are four usable instrument channels: two flexible and two static. The flexible channels have 90-degree articulation which accommodate specialized flexible instruments (scissors, clip applicers, etc) necessary for laparoscopic cases. A proof of concept study was performed on an in-vivo female pig for possible use in laparoscopic kidney surgery.

Methods: A single 2 cm mid-line incision was made on an anesthetized female pig, and the SPIDER was inserted and mounted to a table bracket. Flexible instruments were inserted through its 2 lateral flexible channels, while an endoscopic camera was inserted through its static channel at the center of the device. A ball extension is placed onto the socket of an external mount to hold the instrument during use and allows rotational movement throughout the procedure. The device was tested for ergonomic ease of use and accuracy.

Results: Bilateral nephrectomies were performed on the pig in similar fashion to a regular three-port laparoscopic approach. Surgeon feedback was favorable with respect to ease of use. The SPIDER system was found to be easy to use.

Conclusion: This case study showed proof of concept that the novel SPIDER system surgical instrument could potentially be used for renal surgeries through the LESS approach. Future studies will be conducted to determine its efficacy.

Figure 1: The SPIDER system uses a single channel (left) to transport its instrumentation (right) which triangulates inside the body and offers 90-degree articulation.
ABSTRACTS

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COMPLICATIONS DURING THE INITIAL EXPERIENCE WITH LAPARO-ENDOSCOPIC SINGLE SITE (LESS) PYELOPLASTY

C Donnally1, SL Best1, SA Mir1, CR Tracy2, JD Raman3, JA Cadeddu1

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Introduction: Although LESS pyeloplasty has cosmetic benefits, other improvements in morbidity, such as decreased pain or length of stay, have yet to be shown. The procedure itself is more technically challenging than conventional laparoscopic pyeloplasty due to instrument competition for a limited working space and restricted working angles. The learning curve for this complex reconstructive operation has yet to be determined. To that end, we review our first 22 LESS pyeloplasties, focusing on 30 day complication rates.

Methods: After IRB approval was obtained, patient charts were analyzed to identify any complications that occurred either operatively or in the first 30 days postoperatively. We also analyzed length of hospital stay and the duration of surgery. Complications were categorized according to the Clavien system.

Results: Since our first case in October 2007, we have performed a total of 22 LESS pyeloplasties. The average length of stay in our series was 71 hours (range: 45-149 hours) and mean operative time was 198 minutes (range: 173-240 min). Eight complications were identified in 7 patients (32%). Six out of 7 patients were in the first 8 cases we performed. Only one complication occurred in the subsequent 14 patients (7%). There were two Clavien Grade (CG) 1 complications, including one patient who had gross hematuria that prolonged hospital stay by 2 days and another with urine leakage that resolved spontaneously after the individual went home with surgical drain for a week. Four patients required nephrostomy tube placement (CG3a complication, 18%) during the early postoperative period, two for symptomatic obstruction despite the ureteral stent and two for a urine leak. One patient (4.5%) developed a retroperitoneal hematoma and required transfusion of 2 units of blood (CG2 complication). Finally, one patient’s stent migrated proximally (4.5%) necessitating ureteroscopy to remove the stent (CG3b complication).

Conclusion: LESS pyeloplasty is a technically difficult procedure even for a skilled laparoscopist. Surgical challenges of this novel technique may translate into a higher complication rate early in the learning curve than conventional laparoscopic pyeloplasty. However, within relatively few cases, the complication rate appears to drop and approximates that published for standard laparoscopic pyeloplasty.


<table>
<thead>
<tr>
<th>Complication Grade</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Deviation from the normal postop course without the need for intervention, ie pharmacological, radiological or surgical</td>
</tr>
<tr>
<td>II</td>
<td>Minor complications required pharmacological intervention, including blood transfusion and total parenteral nutrition</td>
</tr>
<tr>
<td>III</td>
<td>Complications required surgical, endoscopic or radiological intervention, but self-limited</td>
</tr>
<tr>
<td>IIIa</td>
<td>Intervention without general anesthesia</td>
</tr>
<tr>
<td>IIIb</td>
<td>Intervention with general anesthesia</td>
</tr>
<tr>
<td>IV</td>
<td>Life threatening complications requiring intensive care unit management</td>
</tr>
<tr>
<td>IVa</td>
<td>Single organ dysfunction (including dialysis)</td>
</tr>
<tr>
<td>IVb</td>
<td>Multi-organ dysfunction</td>
</tr>
<tr>
<td>V</td>
<td>Deaths resulting from complications</td>
</tr>
</tbody>
</table>
ABSTRACTS

ABSTRACT 78

STEREOTACTIC RADIOSURGERY FOR LOCALIZED PROSTATE CANCER:
INITIAL EVALUATION OF ACUTE TOXICITIES

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INTRODUCTION: We prospectively collected data, including PSA levels, AUA symptom score (AUA SS), Sexual Health Inventory for Men (SHIM) score, and acute and late toxicities of patients treated with extracorporeal fractionated stereotactic radiosurgery for men with low risk prostate cancer.

METHODS: Thirty men with localized prostate cancer were enrolled prospectively in an IRB-approved protocol. Patients were treated to a dose of 36.25 Gy in 5 fractions. PSA values, AUA SS, SHIM scores, and NCI CTC acute and late toxicities were analyzed prior to radiosurgery and at 1, 3, 6, and 12 months post treatment.

RESULTS: Mean patient age was 65 (range 48-79). Mean pre-treatment PSA was 4.8 (range=0.64-9.36). Mean PSA declined to 25% of pretreatment levels at 12 months post therapy (p=0.0001). Mean pre-treatment AUA SS was 7.5, increasing to 12 at one month post treatment, decreasing to 8.5 at six months and finally settling at 10.8 at twelve months post therapy, which was not statistically significant compared to baseline values (p=0.262). Mean SHIM scores were 14.3 at baseline and decreased to 12.3 at one year post therapy (p=0.009). When reviewing the acute (<3 months) toxicities, there were five grade 1 toxicities, four grade 2 toxicities and two grade 3 toxicities. All acute toxicities resolved by 3 months post radiosurgery. No grade 4 toxicities were identified at 3 months post treatment. In terms of late toxicities, there were four grade 2 toxicities and two grade 3 toxicities.

CONCLUSIONS: Extracorporeal fractionated stereotactic radiosurgery for patients with localized prostate cancer appears to be safe in our early initial assessment. No grade 4 toxicity was identified in the first 3 months of follow-up with resolution of all grade 1-3 toxicities at 3 months post treatment. Mean AUA SS doubled at 1 month post treatment and declined to baseline values by 3 months post therapy. Mean SHIM score declined by only 2 points at one year post therapy. Although our early data are encouraging, continued evaluation is ongoing and longer follow-up is necessary in order to document oncologic durability.
CORRECT APPLICATION REPRESENTS A KEY ISSUE FOR EFFICIENT SHOCK WAVE LITHOTRIPSY

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Introduction: The sophisticated technology and design of modern lithotripters ensures comfortable shock wave therapy but do not respect, that shock waves are an acoustic phenomenon, causing manifold interactions with all media in the shock wave propagation path. All users should be aware of this fact and keep in mind that only a proper shock wave application enables reproducible results.

Methods: A review of relevant literature (PubMed) regarding shock wave application, our own experimental findings, and an analysis of our experience with more than 20,000 SWL-procedures have been used, to identify the most important factors for an efficient shock wave application.

Results:
Efficacy of SWL correlates significantly with the amount of transferred shock wave energy into the target area (stone). All structures (air bubbles, bone structure) in the shock wave propagation path with acoustic properties (impedance) different from water lead to an attenuation of the shock wave and in consequence to a deteriorated stone fragmentation. For a favourable SWL outcome, the user should keep his eyes on the following aspects:

1. Shock wave coupling:
The contact area between shock wave system and patient’s skin represents the first barrier for the energy transfer, because air pockets in this interface reduce the amount of shock wave energy significantly. An air bubble-free coupling will be achieved with the use of a sufficient amount of low viscous ultrasound gel and minimized handling of the gel.

2. Shock wave propagation path:
The shock wave propagation path inside the patient’s body must be free of any obstacles like bones (ribs, iliac crest) or gas filled intestine, to avoid a decrease of shock wave energy in the focal area. Inline fluoroscopy/ultrasound is a useful tool, to monitor the path along the shock wave axis. In case of any interfering structures, the patient should be transferred in an oblique position, until the blast path is free of any disturbing structures.

3. Target stability:
Only shock waves, directed to the stone will have disintegrative effect. Sufficient i.v. analgesia and abdominal compression with a compression belt is able to reduce patient’s movement and flattens respiratory excursions. Stone movements are reduced and a bigger fraction of shock waves will hit the stone with the consequence of improved stone fragmentation.

4. Shock wave administration rate (SW/min.):
The tensile part of the shock wave induce the rapid growth of transient gas bubbles (cavitation) in the fluids along the shock wave path (coupling bellows, body tissue) with a lifespan of approx. 500 ms. A low shock wave administration rate (60 SW/min. or less) ensures a cavitation free blast path during shock wave release without attenuation of shock wave energy.

Conclusion: With a better understanding of the shock wave physics, the user can take some precautions for an optimized energy transfer during SWL procedures. “Good clinical practice” in lithotripsy represents an easy way to improve SWL results without any additional costs.
APPLICATION OF ICE COLD IRRIGATION DURING VASCULAR PEDICLE CONTROL OF RADICAL PROSTATECTOMY: ENSEAL INSTRUMENT COOLING TO REDUCE COLLATERAL THERMAL TISSUE DAMAGE

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2Section of Urology, University of Chicago Medical Center, Chicago, IL
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5Memorial Sloan-Kettering Cancer Center, New York, NY

Introduction: Energy-based hemostasis of the prostatic vascular pedicles (PVP) during robot assisted radical prostatectomy (RARP) may cause collateral thermal injury to adjacent neural tissue and has been shown to negatively impact sexual function recovery. The unique engineering design of the EnSeal® (Ethicon, Cincinnati, OH) has been demonstrated to limit collateral thermal tissue damage to ≤1.0 mm. Use of tissue and instrument cooling prior to, and during device activation may potentially further reduce thermal spread. As such, we sought to evaluate the collateral tissue effects of Enseal®, with or without cold saline irrigation (CSI), during PVP control.

Methods: The EnSeal® Trio device was used for PVP control in 20 consecutive men undergoing bilateral, non-nerve-sparing RARP. Ipsilateral vascular pedicles were randomly selected to EnSeal® plus CSI (≤ 4°C) application to the tissue before and during device activation or EnSeal® alone. The primary endpoint was the distance of thermal injury from the inked margin using both Hematoxylin & Eosin (H&E) and terminal transferase uridyl nick end-labeling (TUNEL) apoptosis staining. A mean of 3 measurements were taken for each pedicle. Pathological analysis was performed by a single, blinded uro-pathologist.

Results: Mean distance of thermal injury from the inked margin using H&E staining was 0.31 mm (range 0.15-0.40 mm) and 0.98 mm (range 0.7-1.2 mm) for the EnSeal® plus CSI and EnSeal® alone, respectively (p<0.0001). TUNEL staining also demonstrated lateral tissue damage of 0.39 mm (range 0.2-0.5 mm) and 1.12 mm (range 0.9-1.3 mm), respectively (p<0.001). No complications related to hemostasis or post-operative bleeding were observed in the study.

Conclusion: The hemostatic properties of EnSeal® work effectively when submerged in CSI. Adjacent thermal tissue damage is significantly minimized with the addition of CSI. This may have a beneficial impact on nerve preservation and sexual function outcomes following RARP.
ROBOTIC PROSTATECTOMY IN THE OBESE AND MORBIDLY OBESE: MUST WE DELAY OR DENY?

Benjamin Gibson, Ronney Abaza
Ohio State University Medical Center and James Cancer Hospital

Introduction: The feasibility of robotic prostatectomy (RALP) in obese patients with body mass index (BMI) $\geq 30$ kg/m$^2$ has been demonstrated, but with increased operative times, positive margins, and complications according to published reports. Consequently, some surgeons will deny surgery to obese patients or require them to lose weight before offering surgery. We offer RALP to men regardless of weight and do not delay surgery for weight loss. We sought to assess perioperative outcomes of the obese and morbidly obese (BMI $\geq 40$ kg/m$^2$) to determine whether RALP is reasonable.

Methods: We reviewed RALP procedures performed by a single surgeon (RA) between March 2008 and September 2009. All patients underwent lymphadenectomy. Perioperative outcomes were analyzed and compared for BMI <30, 30-39, and $\geq 40$ kg/m$^2$.

Results: Mean BMI among all 401 patients was 30 kg/m$^2$ (range, 19-51 kg/m$^2$). Of these, 189 patients were of BMI<30 (mean 27), 189 were obese (mean BMI 33), and 23 were morbidly obese (mean BMI 43). There was no difference in PSA, biopsy grade, clinical stage, proportion electing for nerve-sparing, or proportion with previous abdominal surgery. All procedures were completed robotically. Mean operative time was not statistically significantly different at 152 min, 159 min, and 167 min for normal, obese, and morbidly obese patients, respectively. Estimated blood loss rose with weight at 108mL, 129mL and 150mL for normal, obese, and morbidly obese (p<0.05), but the transfusion rate was 1% for normal and obese patients and 0% for the morbidly obese. Mean length of stay was 1.06 days in the normal group, and all obese and morbidly obese patients were discharged on postoperative day one. Mean catheterization time was 5.5d in normal, 5.7d in obese, and 4.1d in morbidly obese patients with no cystogram leaks or need for catheter beyond 7d in any morbidly obese patients. Mean lymph node yield was >11 in all three groups and did not differ significantly with similar grade, stage, and tumor volume distribution on final pathology. Positive margins in T2 disease were found in 7.1%, 9.8%, and 0% of normal, obese, and morbidly obese patients, respectively, and in T3 disease in 38.3%, 40%, and 40%. Complications within 6 months of any severity occurred in 10.1%, 7.9%, and 8.7% of normal, obese, and morbidly obese patients, respectively.

Conclusions: Robotic prostatectomy is feasible in the obese and morbidly obese. Perioperative outcomes are not unfavorable for the morbidly obese such that robotic surgery can be offered regardless of weight.
ABSTRACTS

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HIGH INTENSITY FOCUSED ULTRASOUND (HIFU) THERAPY OF LOCALIZED PROSTATE CANCER: 10 YEARS DEVELOPMENT
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INTRODUCTION AND OBJECTIVES: Objective was to analyze the impact of TURP on the treatment efficacy of HIFU. We compared identical patient cohorts of primary T1-2 treated with HIFU mono- or TURP combination therapy over the last 10 years.

METHODS: The groups were stratified as follows: Patient cohorts 1998 – 2000: HIFU Monotherapy without TURP. 2001 – 2004: TURP and HIFU in one session. 2005 – 2008: 50 % of the patients had combined treatment, 50 % had TURP one month before HIFU. All patients were treated completely with Ablatherm HIFU. Initial PSA at diagnosis, PSA and prostatic volume before TURP/HIFU and PSA Nadir approximately 6 weeks after treatment were analyzed.

RESULTS: The impact of TURP on prostatic volume is shown in table 1. The residual prostate volume after 6 months was median 7 cc (3-25). The differences of PSA Nadir in the 3 groups are given in table 2.

CONCLUSION: TURP before HIFU adapts each prostate independent from size, form and calcifications and enables complete HIFU treatment. TURP reduces post HIFU tissue sludging, prevents strictures and increased HIFU efficacy. We were able to show that lowest PSA Nadir can be reached when TURP is performed 4 weeks before HIFU.
IN VIVO EVALUATION OF HIGH POWER 532 nm LASER AND NEW FIBER ON TISSUE VAPORIZATION

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¹ American Medical Systems, Inc., San Jose, CA
² American Medical Systems, Inc., Minnetonka, MN

Introduction: To reduce photoselective vaporization of the prostate (PVP) time for larger prostate glands, more powerful 532-nm 180-W GreenLight™ XPS™ was developed. A new prototype 750-µm core-diameter side-firing fiber was also developed to deliver high power levels safely and effectively. In this study, we investigated anatomic and histologic outcomes and vaporization efficiency parameters of 180-W XPS laser performed with the new 750-µm prototype fiber in a surviving study of living canines.

Methods: 8 male (6~8 years old) canines underwent anterograde PVP with the 180-W laser delivered through a new, thicker (750-µm vs. the existing 600-µm core-diameter), 50% larger spot-sized side-firing fiber. 4 each animals were euthanized 3 hours or 8 weeks postoperatively. Laser energy and lasing time were recorded. Prostates were sectioned, measured, and histologically analyzed after hematoxylin and eosin (H&E), triphenyltetrazolium chloride (TTC), or Gomori trichrome (GT) staining and compared with a normal control. Depth of coagulation necrosis was measured in 4 (3-hours) animals.

Results: PVP with the 180-W laser bloodlessly created a 76% larger cavity (mean 11.8 vs. 6.7 cm³; \( p = 0.014 \)) and vaporized tissue at a 77% higher rate (mean 2.3 vs. 1.3 cm³/min; \( p = 0.03 \)) while H&E- and TTC-staining demonstrated its 33% thicker mean coagulation zone (2.0±0.4 vs. 1.5±0.3 mm) vs. 120-W laser PVP. H&E-stained cross-sectional prostatic tissue specimens from the 3-hour (acute) group showed histologic evolution of concentric non-viable coagulation zone, partially viable hyperemic transition zone of repair, and viable non-treated zone. H&E- and GT-stained specimens from the 8-week (chronic) group revealed healed circumferentially epithelialized, non-edematous, prostatic urethral channels with no increase in collagen in the subjacent prostatic tissue vis-à-vis the normal control.

Conclusion: Our canine study demonstrates GreenLight™ XPS™ 180- W 532-nm LBO laser PVP with its new fiber has a significantly higher vaporization rate and speed, with a more hemostatic coagulation zone, but equally favorable tissue interaction and healing, vis-à-vis those of HPS™ 120-W laser PVP.

Figure 1. Transverse sections of fresh canine prostates after 180-W LBO laser PVP: A. unstained acute tissue (cavity encircled by hyperemic ring), B. TTC-stained acute tissue (CZ: coagulation zone, TZ: transition zone, NLZ: non-treated live zone), C. unstained chronic tissue (complete tissue healing and repair).

Figure 2. Histologic appearances of normal control and 8-weeks postoperative canine prostates stained for collagen with Gomori trichrome (GT). Cross-sectional (×1) view shows newly created post-operative large prostatic channel in contrast to that in non-operated normal control. In healed 8-weeks postoperative prostate, lumen is re-epithelialized and subjacent prostate shows no increase in collagenous fibrous scarring compared with normal control.
ABSTRACT # 84

IMPROVED EX VIVO ORGAN MODEL FOR PERCUTANEOUS KIDNEY SURGERY

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¹ Department of Urology and Urologic Oncology, Hannover Medical School, Hannover, Germany
² Department of Urology, Bezirkskrankenhaus Hall in Tirol, Austria

Introduction: Percutaneous renal surgery is still demanding and success mostly hampered by the lack of adequate training facilities. We therefore improved a porcine kidney-training model for percutaneous renal access and intrarenal procedures.

Methods: We prepared a biologic training model using porcine kidneys coated by a full-thickness porcine skin flap with subcutaneous tissue. The ureter of each kidney was prepared, multiple stones were placed into the renal pelvis using the 18F access sheath of the minimal invasive PNL-Set (Karl Storz, Fig. 1A) and a indwelling catheter was placed and fixed in the ureter by ligature for further irrigation with saline or contrast medium (Fig. 1C). For initial training purposes with an eased access to the collecting system, a standard guidewire was inserted through the ureter transparenchymal. For advanced training of percutaneous the kidney was punctured under radiographic or ultrasound guidance. Percutaneous renal manipulations, such as minimally invasive percutaneous nephrolithopaxy (MIP), were then practiced on the model. The participants of a training course evaluated the organ model with a questionnaire.

Results: All trainees were urologists with experience in endourologic surgery. All 25 trainees participating the percutaneous hands-on training attained access to the renal pelvis using models with readily placed guidewires. Subsequent renal surgery was successful in all cases. Percutaneous puncture under ultrasound guidance and following intrarenal surgery was successful in 23 (92%) cases. All participants rated the model helpful for simulating percutaneous renal surgery.

Conclusion: This kidney model is simple, easy to build and cost effective using only few standard readily available materials. It provides realistic and reproducible practice for percutaneous renal surgery in the laboratory. The presented improved organ model approximates natural circumstances precisely by using a full-thickness skin flap with the fatty subcutaneous tissue. The anatomical retro-peritoneal structures are represented naturally.

Figure 1: Placement of stones (A), pelvic catheter (B), wrapped kidney (C), intrarenal surgery (D) and pyelography (E)
OUTCOMES OF ROBOTIC PARTIAL NEPHRECTOMY FOR COMPLEX RENAL MASSES WITH A Nephrometry Score ≥ 7

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Introduction: To evaluate the safety and feasibility of robotic partial nephrectomy (RPN) for patients with complex renal masses.

Methods: We reviewed data for 139 consecutive patients who underwent transperitoneal RPN at a tertiary care center between June 2006 and March 2010. A total of 57 patients were identified from the total cohort and classified as having complex renal masses according to the R.E.N.A.L. nephrometry score (≥7). Preoperative, perioperative, pathologic, and functional outcomes data were analyzed.

Results: Mean BMI was 30.8 kg/m² (range 19.9-44.8). There were 34 males and 23 females with 26 right sided masses and 31 left sided masses. Mean tumor size was 3.6 cm (range 0.8-8.5) and mean operative time was 180 minutes (range 120-300). The mean estimated blood loss (EBL) was 306 ml (range 50-2200) and warm ischemia time was 21.2 minutes (range 6-41). Mean hospital stay was 3.8 days (range 2-14). Estimated glomerular filtration rate (eGFR) was calculated at a mean decrease of 6.51 ml/min/1.73 m² (range -66-34). According to the Clavien-Dindo classification of surgical complications there were 3 grade one complications, 10 grade 2 complications, and 2 grade 3 complications. All margins were pathologically negative and after a mean follow-up of 10 months there were no recurrences.

Conclusion: RPN is safe and feasible for patients with complex renal masses as defined as ≥ 7 on the R.E.N.A.L. nephrometry score.
LAPAROENDOSCOPIC SINGLE SITE PARTIAL NEPHRECTOMY IN A HYPERTENSIVE PORCINE MODEL USING THE SLIDING CLIP TECHNIQUE

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Introduction: Laparoendoscopic single site (LESS) partial nephrectomy (PNx) is in the developing phase. Rapid and safe haemostatic renorrhaphy during LESS PNx is technically challenging due to the inherent limitations of LESS surgery such as loss of triangulation and instrument clashing. The sliding clip technique has been described in the robotic literature. Our objective is to test the feasibility and safety of the sliding clip technique in LESS PNx. Our hypothesis is the sliding clip technique is an efficient, rapid, and safe method of renorrhaphy in LESS PNx.

Methods: We performed bilateral LESS PNx in 4 pigs after having obtained approval from institutional Animal Care and Use Committee. We started the procedure by placing an arterial line using a carotid cut-down for instantaneous blood pressure monitoring. The Triport® (Olympus,USA) & SILS port® (Covidien, USA) were used equally for access along with the 5 mm flexible tip Endoeye® (Olympus,USA) for vision. Roticulating scissors and dissector were used in addition to straight instruments. We inserted a 3 mm clamp in the upper midline to allow for clamping of the renal artery on each side. Renorrhaphy was performed using 2-0 polytrimethylene carbonate on a GS-21 needle. We applied bolsters in the first 4 procedures but omitted their use in the last 4 procedures. After finishing the renorrhaphy, the artery is unclamped. If there is no bleeding for 5 minutes post unclamping, intravenous dopamine is infused and titrated to raise the systemic pressure to more than 180 mmHg.

Results: Eight LESS PNx were performed. None of the renorrhaphy leaked after unclamping or after raising the pressure more than 180 mmHg. Warm ischemia time was more than 1 hour in the first 4 procedures while it improved to less than 30 minutes in the last 4 procedures as we gained experience.

Conclusion: The sliding clip technique is feasible and safe in LESS PNx. Clinical application of this technique needs to be tested after having obtained satisfactory outcome in the animal model. The learning curve for LESS improves rapidly during the first 8 cases.
POTASSIUM TITANIUM OXIDE PHOSPHATE LASER ROBOTIC-ASSISTED LAPAROSCOPIC PARTIAL NEPHRECTOMY: INITIAL CLINICAL EXPERIENCE IN THE UNCLAMPED KIDNEY

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Introduction: Laparoscopic partial nephrectomy is increasingly being used in the resection of select renal masses, however technical demands and concerns over warm ischemia length have limited its use. New technologies may offer solutions to the most challenging aspects of this procedure including collecting system reconstruction and hemostasis. The goal of this study was to determine whether the Potassium Titanium Oxide Phosphate (KTP) laser can facilitate robotic-assisted laparoscopic partial nephrectomy (RALPN) without hilar occlusion.

Methods: From January 2007 to May 2007, 5 patients underwent RALPN using the da Vinci robotic system and 80W KTP laser (532nm) with IRB approval. Inclusion criteria were an exophytic, solid renal mass with a diameter of ≤4cm in a midzone or lower pole location. A novel 5mm laser delivery tool was specifically engineered to allow the passage of a custom-built 400µm end-firing fiber. Patients underwent standard laparoscopic dissection followed by robotic docking, laser resection, and robot-assisted renorrhaphy Figure 1.

Results: KTP laser RALPN without initial hilar clamping was performed in all patients. Patient and operative characteristics are given in Table 1. Hilar clamping with 14 minutes of warm ischemia was necessary in one case to achieve hemostasis. In all cases, hemostatic suture ligation and adjunctive hemostatic maneuvers were used (including Surgicel in 2, bolster in 2, hemostatic clips in 1, and hemostatic agents in 4). The median EBL was 400 (200-1300) mL. Hemorrhage occurred in 2 patients, requiring intraoperative transfusion and postoperative embolization with transfusion, respectively. Decreased visualization due to intraoperative smoke generation was apparent in all cases. One surgical margin was focally positive.

Conclusion: RALPN utilizing the KTP laser without hilar clamping is technically feasible. Further developments are required to improve hemostasis and decrease smoke generation prior to widespread application of this technique.

Table 1: Patient Characteristics

<table>
<thead>
<tr>
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<th>Median (Range)</th>
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<td>Age (years)</td>
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<tr>
<td>ASA</td>
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<tr>
<td>BMI</td>
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<tr>
<td>Laterality (L:R)</td>
<td>3:2</td>
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<tr>
<td>Tumor size (cm)</td>
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<tr>
<td>Operative time (min)</td>
<td>310 (180-360)</td>
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<tr>
<td>Resection time (min)</td>
<td>54 (36-96)</td>
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<tr>
<td>Lasing time (min)</td>
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<tr>
<td>Total energy (kJ)</td>
<td>20.9 (9.9-29.1)</td>
</tr>
<tr>
<td>EBL (ml)</td>
<td>400 (200-1300)</td>
</tr>
<tr>
<td>Length of Stay (days)</td>
<td>3 (3-7)</td>
</tr>
</tbody>
</table>

Figure 2: Clinical application of KTP laser RALPN
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INTRARENAL PRESSURES GENERATED DURING DEPLOYMENT OF VARIOUS ANTIRETROPULSION DEVICES IN AN EX VIVO PORCINE MODEL

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Introduction: Pressurized saline irrigation is commonly used during ureteroscopy, which can cause an increase in intrarenal pressure leading to post-operative pain, sepsis, and renal injury due to pyelovenous and pyelolymphatic backflow. To prevent retrograde stone migration during ureteroscopic lithotripsy anti-retropulsion devices can be deployed, which may or may not protect the kidney against high intrarenal pressures. This study compares the intrarenal pressures generated during the use of two antiretropulsion devices in an ex vivo porcine model.

Methods: Using an ex vivo porcine model of the urinary system, flexible ureteroscopy was performed at the proximal, mid, and distal ureter. Intrarenal pressures were measured in the absence and presence of a coil-based antiretropulsion device and a multi-fold film-based device. Intrarenal pressure measurements were obtained while using saline irrigation at gravity (84 cmH\textsubscript{2}O) and pressures of 150 and 300 mmHg.

Results: The deployment of a coil device resulted in a significant increase in intrarenal pressures during ureteroscopy with pressurized irrigation when compared to intrarenal pressures without a device. The use of a multi-fold film device that occluded the ureter during ureteroscopy resulted in a decrease in intrarenal pressures at an irrigation pressure of 300 mmHg when compared to pressures without a device. In the remaining configurations, the intrarenal pressures were only minimally elevated. When comparing the two devices to each other, the multi-fold film device had significantly lower intrarenal pressures at each configuration. This has potential implications in preventing renal injury and/or sepsis during ureteroscopy.

Conclusion: The use of a multi-fold film antiretropulsion device during ureteroscopy with high-pressure irrigation can potentially protect the kidney from elevated intrarenal pressures.
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TOWARD ADAPTIVE STEREOTACTIC ROBOTIC PROSTATE CANCER BARCHYTERAPY: ADAPTIVE CLINICAL WORKFLOW INCORPORATING INVERSE PLANNING AND AN MRI STEALTH ROBOT

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2 Department of Radiology, University of California, San Francisco, CA, USA
3 Department of Urology, University of California, San Francisco, CA, USA
4 Brady Urological Institute, Johns Hopkins University, Baltimore, MD, USA

Introduction: To translate any robot into a clinical environment, it is critical that the robot seamlessly integrate with all the technology of a modern clinic: it must be incorporated into a clinical workflow. The specific objective is to integrate the robot into the image/plan/deliver (IPD) workflow (Figure). We will also show that a robotic device can augment the IPD workflow into a fully adaptive procedure: image/plan/begin-delivery/image/plan/finish-delivery.

Methods: An MR-stealth brachytherapy (BT) delivery device (MRBot), was used in a closed-bore 3T MRI and a clinical BT cone beam CT (CBCT) suite. Targets included ceramic dummy seeds, MR-Spectroscopy (MRS) sensitive metabolite, and a prostate phantom. Acquired DICOM images were exported to BT planning software to register the robot coordinates in the reference frame of the imager, contour and verify target locations, create dose plans, and export needle and seed positions to the robot. To demonstrate adaptive dose planning, a CBCT of a prostate phantom was acquired and contoured. The clinical inverse planning algorithm, IPSA, was used to generate a seed placement plan. Coordinates for 10 needles and 29 seeds were transferred to the robot. After every two needles placed, the phantom was re-imaged. Already-placed seeds were identified prior to placing the seeds in the next two needles.

Results: An adaptive workflow was demonstrated by acquiring images after needle insertion and prior to seed deposition. Also demonstrated was the ability to robotically deliver seeds to locations determined by an anatomy-based seed-location planning system, and the ability of the system to incorporate novel (non-template-based) seed/needle patterns that can avoid penetrating sensitive organs (e.g., penile bulb, rectum, urethra) and circumvent the pubic arch. The coordination of each system element (imaging device, BT planning system, robot control, robot) was validated with a seed delivery accuracy of within 2 mm in both a phantom and soft tissue.

Conclusion: MRBot was incorporated into a clinical workflow by demonstrating these proofs of concept: (1) ability to link multiple coordinate systems, (2) ability to guide a needle-placement robot using MR spectroscopy, (3) ability to implement an image guided workflow, and (4) ability to perform adaptive image-guided inverse-planned robotic delivery in both CBCT and MRI environments. This process allows for needle adjustment (retraction and reinsertion) in case the needle is in the wrong position. The MRI-stealth robotic system, MRBot, was used for the first time in a clinical CBCT environment. It was successfully shown that the reference systems of both imaging devices, the brachytherapy planning system, and the robot control can be registered to guide the delivery of brachytherapy seed precisely to the physician-determined target.

Figure 1: An adaptive IPD workflow begins with the acquisition of images of the patient which are then transferred via DICOM format to a treatment planning system where the anatomy is contoured and the needle and seed locations (i.e., a dose plan) are determined. The dose plan is transferred to the robot control unit which executes the instructions necessary to position the robot to insert the needles and deliver the seeds. Prior to placing all the seeds, adaptive planning would return to the beginning of the workflow to re-image, determine the actual position of the already-placed seeds, and re-plan the remaining seeds if necessary to fine tune the dose distribution.
**ABSTRACT 90**

**ANALYSIS OF PROSTATE AREA SAMPLED BY TRUS PROSTATE BIOPSIES**

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**Introduction:** Prostate cancer is the most common non-skin cancer in men and the second leading cause of cancer death among them. In routine practice, cancer is diagnosed by performing biopsies to sample the prostate using a 2D Trans-Rectal Ultrasound (TRUS) probes equipped with a rigidly attached guide for spring needle guns. In this study, we computed the surface of each prostate lobes (Right and Left) sampled in routine practice.

**Methods:** In order to increase prostate biopsy accuracy a device called UroStation™ has been developed (Koelis [1]). It is based on a 3D TRUS linked to a computer with a network cable. Using image-based registration algorithm [2] the UroStation™ is able to give geometric information in a fixed reference space with respect to the prostate. The biopsy gun pushes the needle in the prostate on 22 millimeters and the needle orientation is given by the TRUS probe. So using the needle tip coordinates and the probe orientation, one can derive the coordinates of the needle entry point in the prostatic capsule. We developed an algorithm able to compute the pierced area in each prostate lobe during the first twelve biopsies, 6 in the right lobe [Figure 1] and 6 in the left lobe.

**Results:** We used data recorded on 78 patients subject to navigation-assisted prostate biopsies. The examinations have been performed by three different urologists between January and November 2009. The pierced surface varies a lot between individuals and has a tendency to be correlated with the prostate volume [Figure 2]. The averaged pierced area for one lobe is about 1 cm² only. It also appeared that the left lobe pierced surface is in average bigger than the right lobe one.

**Conclusion:** It appears that the pierced area is more important for the left lobe than for the right one. This could be due to a weaker precision during the biopsy of the left lobe, which results in an underestimation of the probe displacement by the surgeon. The results we get also indicate that patients undergo very different examinations one from the other, that probably don’t have the same accuracy in cancer detection. A new study, crossing these results with medical data such as cancer detection is currently performed.

**References:**


THE USE OF SINGLE LUNG HIGH-FREQUENCY OSCILLATING VENTILATION TO MINIMIZE MOVEMENT OF UPPER ABDOMINAL ORGANS DURING HIGH PRECISION PERCUTANEOUS INTERVENTIONS

Roger Li, Donald Pick, Michael K. Louie, Joseph Rinehart, Debra Morrison, Anne Wong, Duane Vajgrt, Elspeth M. McDougall, Ralph V. Clayman

Departments of Urology, Anesthesiology, and Radiology, University of California - Irvine

Introduction: High-frequency oscillating ventilation (HFOV) has value in percutaneous procedures where the precision and safety of the intervention is hindered by normal respiratory movement. Two cases are presented where HFOV was successfully used in conjunction with contralateral one-lung ventilation to provide a stable and safe field for percutaneous renal cryoablation.

Methods: Two patients were treated: A 67 year old man with a 2 cm right upper pole renal mass, and a 74 year old woman with a left 2.9 cm upper pole renal mass. In both cases, preoperative CT scans showed close proximity between the lower pleural edge and the proposed path of the cryoablation needle. To prevent pleural injury, contralateral lung HFOV was performed in order to stabilize the position of the ipsilateral lung. A 5F Yueh centesis needle was also used to inject saline and float the kidney away from other adjacent structures. Multiple Galil Icerods® were used in each patient to cryoablate the renal lesions after confirming biopsy. In addition, multi-temperature probes were used to verify a -20°C temperature and predict cell death.

Results: Both patients tolerated one-lung HFOV without complication. Renal cryoablation was performed without pleural injury, and both patients were discharged home after 23 hour observation.

Conclusion: Percutaneous renal cryoablation, at our institution, is a multidisciplinary effort by the anesthesiologist, urologist, and interventional radiologist. Difficult lesions that would otherwise require laparoscopic or open surgical techniques are successfully treated using techniques such as HFOV and single lung ventilation.
COMPARATIVE ANALYSIS OF TRI PORT AND QUAD PORT IN A PORCINE MODEL

Jitendra Jagtap, MD, Abraham Kurien, MD, Arvind Ganpule, MD, Ravindra Sabnis, MD, Mahesh Desai, MD

Introduction and objective: The aim of this study was to objectively study and compare TriPort™ and QuadPort™ (Advanced surgical concepts, Ireland) in a porcine model.

Methods: A simple nephrectomy was performed in 2 female porcine models of similar breed and weighing 33 and 35 kg respectively using TriPort™ and QuadPort™ by a single surgeon. The porcine models were anesthetized, painted, and draped and the 2 ports were inserted through an incision made in the abdominal wall near the midline. A standard simple nephrectomy was performed thereafter. The parameters studied were as follows: technical specifications, port introduction, length of incision, slippage, range of movement, instrument clutter, operative time, CO2 requirement, blood loss, surgeon’s VAS score, etc.

Results: The results are as follows:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Triport</th>
<th>Quadport</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical details:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• No. of instrument ports (size in mm)</td>
<td>Three (12,5,5)</td>
<td>Four (15,10,10,5)</td>
</tr>
<tr>
<td>• Area of aperture (cm²)</td>
<td>4.9 cm² (incison : 2.5cm)</td>
<td>28.3 cm² (incison : 6cm)</td>
</tr>
<tr>
<td>• Distance between 2 working ports</td>
<td>2 cm</td>
<td>4 cm</td>
</tr>
<tr>
<td>• Angle of triangulation (in degrees)</td>
<td>9.5</td>
<td>18</td>
</tr>
<tr>
<td>• Range of movement (in degrees)</td>
<td>150</td>
<td>150</td>
</tr>
<tr>
<td>Intraoperative parameters:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Ease of introduction (scale of 1 to 10; 1- very easy, 10 – extremely difficult)</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>• Length of incision at which port slippage occurred</td>
<td>3 cm</td>
<td>6.5 cm</td>
</tr>
<tr>
<td>• Ability to put precurved instruments</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>• Field of Vision</td>
<td>Same as QuadPort™</td>
<td>Same as TriPort™</td>
</tr>
<tr>
<td>• Instrument clutter (scale of 1 to 10; 1- No clutter at all, 10 – severe clutter)</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>• Time taken (minutes)</td>
<td>66</td>
<td>52</td>
</tr>
<tr>
<td>• CO₂ requirement (L)</td>
<td>345</td>
<td>372</td>
</tr>
<tr>
<td>• Blood loss</td>
<td>20ml</td>
<td>25ml</td>
</tr>
<tr>
<td>• Overall difficulty level to do surgery (scale of 1 to 10; 1- very easy, 10 – extremely difficult)</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>• Requirement of extending incision for specimen retrieval</td>
<td>Yes (from 3 to 4 cm)</td>
<td>No (6.5cm)</td>
</tr>
</tbody>
</table>

Conclusion: We conclude that the Quadport provides more flexibility with the option of adding another port. It also provides better ergonomics with a wider distance between the working ports. It also scored over the Triport in the intraoperative parameters by providing less clutter and facilitating specimen retrieval without the need of extension of the incision. The Triport in contrast gave a smaller scar in view of its smaller size and seems optimum for reconstructive procedures. Both ports are equally safe and efficacious for use in LESS procedures.
ABSTRACT 93

IMAGING OF ANGIOGENESIS BY CONTRAST-ENHANCED ULTRASOUND

M. Mischi¹, M.P.J. Kuenen¹,², H. Wijkstra²
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² Academic Medical Center, Urology Department, Amsterdam, the Netherlands

Introduction: In western countries, prostate cancer is the most prevalent form of cancer in men. Although effective techniques for minimally-invasive focal therapy have been introduced, prostate cancer remains among the three most deadly forms of cancer in men. The reason for this has to be ascribed to the limitations of current diagnostics, which hamper a timely and efficient use of modern therapies. As a result, extensive research has lately focused on the development of novel methods for a reliable and early localization of prostate cancer and, in particular, of those aggressive forms of cancer that have a higher probability of growing and developing metastases. Based on a proven link between cancer aggressiveness and angiogenic processes, most of the proposed methods aim at imaging angiogenesis. To this end, all these methods make invariably use of blood perfusion quantification. However, probably due to a questionable relation between angiogenesis and perfusion, none of these methods has proven sufficiently reliable to replace current diagnostics. We propose a novel approach for angiogenesis imaging that is based on quantification of the (intravascular) local diffusion of an ultrasound contrast agent (UCA). Local diffusion is expected to correlate better than perfusion with the increased microvascularity density due to the angiogenic processes supporting cancer growth.

Methods: Local diffusion is estimated by an intravenous injection of a 2.4 mL bolus of SonoVue™ (Bracco, Milan). The bolus passage through the prostate is measured by contrast-enhanced ultrasound imaging and a large set of time intensity curves (TICs) is obtained at the resolution of the ultrasound scanner. Prior to diffusion analysis, the registered contrast-enhanced ultrasound videos are compensated for their dynamic range compression. The measured TICs are fitted by a proper model that, being a solution of the diffusion with drift equation, provides a kinetic representation of the diffusion process. The main contribution to diffusion is provided by the UCA multipath trajectories through the microvascular bed. Therefore, the proposed method is expected to permit detecting the differences in microvascular architecture due to angiogenesis. A dedicated model-fitting algorithm is used for the estimation of a diffusion parametric image of the prostate (Figure 1). A preliminary validation was performed by comparison with histology data obtained from two patients after radical prostatectomy.

Results: Compared with the histology data, prostate cancer was localized on a pixel basis with a sensitivity and specificity equal to 78% and 92%, respectively. The average area of the receiver operating characteristic (ROC) curves was 0.91. This area was higher than those obtained by testing all the other TIC parameters reported in the literature.

Conclusion: Quantification of local UCA diffusion by contrast-enhanced ultrasound is a promising method for angiogenesis imaging and, in particular, for localization of prostate cancer. A more extensive validation is however necessary to optimize the method and bring it to clinical practice.

Figure: Transrectal contrast-enhanced ultrasound image of the prostate (left) together with the corresponding diffusion image (right) showing a suspicious area on the right side.
INTRODUCTION: We describe our experience with robot-assisted laparoendoscopic single-site surgeries and evaluate a homemade port system as an effective access technique.

METHODS: Between May 2009 and February 2010, 56 consecutive robot-assisted LESS urologic operations were done in our institution. A 4-cm long incision was made over the umbilicus. After the inner ring of the wound retractor was placed into the peritoneum, the operator folded the outer ring of wound retractor three times. Sutures were placed, and the outer ring of the wound retractor was folded again two or three times to prevent air leak from the sutures and hold the wound retractor snug against the abdominal wall. A homemade single port was established by inserting two 12-mm trocars and two 8-mm trocars through fingers of a surgical glove and securing it to the port. If needed, an additional trocar was inserted in the midline below the subxiphoid process or alongside the homemade single port to establish a 12-mm hybrid port. Data were analyzed including patients’ characteristics, operative records, and complications.

RESULTS: Total 58 robot-assisted laparoendoscopic single-site urologic surgeries were done during the study period. Mean patient age was 56 years. Mean body mass index was 23.6 kg/m². Procedures, diagnosis and perioperative results are described in Table 1.

Table 1. Procedures, diagnosis, and perioperative results of robot assisted laparoendoscopic single site surgery

<table>
<thead>
<tr>
<th>Procedures</th>
<th>Diagnosis</th>
<th>Mean Size (cm)</th>
<th>Mean OR time (min)</th>
<th>WIT (min)</th>
<th>Mean EBL (ml)</th>
<th>Transfusion rate (%)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Partial nephrectomy (n=44)</td>
<td>RCC (38)</td>
<td>3.0</td>
<td>220</td>
<td>28</td>
<td>314</td>
<td>16</td>
<td>Margin positive (1)</td>
</tr>
<tr>
<td></td>
<td>Angiomyolipoma (2)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Mini-incisional open conversion (2)</td>
</tr>
<tr>
<td></td>
<td>Oncocytoma (1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Renal vein injury (1)</td>
</tr>
<tr>
<td></td>
<td>Others (3)*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Postoperative bleeding (1)</td>
</tr>
<tr>
<td>Nephroureterectomy (n=9)</td>
<td>Urothelial carcinoma (9)</td>
<td>2.4</td>
<td>227</td>
<td>-</td>
<td>248</td>
<td>11</td>
<td>Acute renal failure (1)</td>
</tr>
<tr>
<td>Radical nephrectomy (n=2)</td>
<td>RCC (1)</td>
<td>9.0</td>
<td>248</td>
<td>-</td>
<td>225</td>
<td>0</td>
<td>Mini-incisional open conversion (1)</td>
</tr>
<tr>
<td>Adrenalectomy (n=2)</td>
<td>Leiomysarcoma (1)</td>
<td>2.5</td>
<td>167</td>
<td>-</td>
<td>250</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Simple nephrectomy (n=1)</td>
<td>Nonfunctioning kidney</td>
<td>-</td>
<td>128</td>
<td>-</td>
<td>100</td>
<td>0</td>
<td>Bowel injury (1)</td>
</tr>
</tbody>
</table>

Abbreviation: RCC, renal cell carcinoma; OR, operating room; EBL, estimated blood loss; WIT, warm ischemic time
* xanthomatous pyelonephritis 1, metanephric adenoma 1, hemorrhagic cyst 1

CONCLUSION: Robot-assisted laparoendoscopic single-site surgeries are feasible and can be safely applied to a variety of urologic operations. Our homemade single port device provides adequate range of motion and is more flexible in port placement for laparoendoscopic single site surgery than the current multichannel port.
ABSTRACT 95

MAGS INSTRUMENTATION FOR LESS/NOTES: LACK OF HISTOLOGIC DAMAGE AFTER PROLONGED MAGNETIC COUPLING ACROSS THE ABDOMINAL WALL

Sara L. Best,¹ Wareef Kabbani, ² Daniel J. Scott,³ Richard Bergs, ⁴ Heather Beardsley, ⁴ Raul Fernandez, ⁴ Lauren B. Mashaud,³ and Jeffrey A. Cadeddu¹

¹ Department of Urology, University of Texas Southwestern Medical Center, Dallas, TX
² Department of Pathology, University of Texas Southwestern Medical Center, Dallas, TX
³ Southwestern Center for Minimally Invasive Surgery, Univ.of Texas Southwestern Medical Center, Dallas, TX
⁴ Texas Manufacturing Assistance Center, Automation and Robotics Research Institute, Univ. of Texas, Arlington, TX

Introduction: Magnetically anchored and guided (MAGS) instruments ameliorate some of the challenges in triangulation created by laparoendoscopic single site and natural orifice translumenal endoscopic surgery. They consist of an intracorporeal magnetic device coupled to an external hand-held magnet used to anchor and “steer” it around the peritoneal cavity. One concern is the potential pathological effect of prolonged compression of abdominal wall between the components.

Methods: 3 pigs (45.5-48.6 kg) underwent laparoscopic placement of magnetic devices in 4 quadrants that were left in place for 2 or 4 hrs. Full-thickness abdominal wall sections (mean = 2.1cm thick) where each MAGS platform was placed plus a control were harvested at zero, 2, or 14 days after surgery. Histologic assessment was then performed.

Results: Beyond mild blanching of the peritoneal surface with a few petechiae immediately after internal component removal, no gross tissue damage was seen. These changes were undetectable by 48 hours and no intraabdominal adhesions were identified at necropsy. NADH stain for tissue viability in the 4 non-survival specimens showed no tissue damage. H&E stain showed no necrosis of either superficial or deep muscle, skin, or subcutaneous fat tissue in all 12 specimens when compared to the control.

Conclusion: MAGS instruments do not appear to cause tissue damage or adverse clinical outcomes when coupled across thin porcine abdominal walls for up to 4 hours. Since the distance across the abdominal wall is generally greater in adult humans, these findings support the further clinical development of magnetic instruments to be used in humans.

This project was funded in part by Ethicon Endo-Surgery, Inc.

Figure 1 - Laparoscopic view of the anterior abdominal wall/peritoneal surface before (A) and after (B) removal of the intracorporeal MAGS cautery device. Note the mild blanching of the peritoneal surface and the petechiae.
ABSTRACTS

ABSTRACT 96

COMPARISON OF SMALL DIAMETER STONE BASKETS IN AN IN VITRO CALICEAL MODEL AND AN IN VITRO URETERAL MODEL

Emily Korman, K Ekkarin Chotikawanich, Kari Hendlin, Manoj Monga
University of Minnesota

Introduction: Three small diameter (<1.5Fr) stone baskets have recently been introduced. Our objective was to evaluate the stone capture rate of these baskets in an in vitro caliceal model and an in vitro ureteral model using novice, resident, and expert operators.

Methods: Sacred Heart Medical Halo (1.5Fr), Cook N-Circle® Nitinol Tipless Stone Extractor (1.5Fr), and Boston Scientific Optiflex™ (1.3Fr) stone baskets were tested in an in vitro caliceal model and an in vitro ureteral model by 3 novices, 3 residents, and 3 expert basket operators. Each operator was timed during removal of a 3 mm calculus with 3 repetitions for each basket using each model. Data were analyzed by ANOVA-single factor tests and t-tests assuming unequal variances.

Results: The Optiflex had the fastest average time using the caliceal model for all groups (novice: 0:40 ± 0:48, resident: 0:10 ± 0:08, overall: 0:22 ± 0:34 minutes) except expert. The Halo had the fastest average time for the expert group (0:07 ± 0:03 minutes). The N-Circle basket had the overall slowest time when using the caliceal model (0:45 ± 0:67 minutes). The Halo had the fastest average rate of stone extraction for experts and novices when using the ureteral model (0:02± 0:01 and 0:08± 0:04 minutes, respectively), as well as the overall fastest average stone extraction rate (0:08± 0:06 minutes). No statistical significant differences in extraction times between baskets were identified in the resident group. The Optiflex had the slowest average extraction rate for all groups, as well as the overall slowest average extraction rate for the ureteral model (0:15± 0:11 minutes).

Conclusion: The Sacred Heart Halo and the Boston Scientific Optiflex baskets resulted in the fastest stone extraction time for the caliceal model. The Cook N-Circle resulted in the slowest stone extraction rate for all groups except expert in the caliceal model testing. The Sacred Heart Medical Halo had the fastest stone extraction rate in the ureteral model.
CLINICAL OUTCOMES OF SECONDARY OR TERTIARY TREATMENT OF BENIGN PROSTATIC HYPERPLASIA (BPH) WITH GREENLIGHT HPS™ LASER PHOTOSELECTIVE VAPORIZATION PROSTATECTOMY (PVP)

Kurt Strom, Xiao Gu, Massimiliano Spaliviero, Carson Wong
University of Oklahoma Health Sciences Center

Introduction: GreenLight Secondary procedure rates of surgical therapy for BPH range between 1 and 14%. We evaluate GreenLight HPS™ laser PVP as a treatment for symptomatic BPH previously treated with surgical management.

Methods: We prospectively evaluated our initial GreenLight HPS™ laser PVP experience. Only patients who failed prior surgical therapy (transurethral prostate resection (TURP), transurethral microwave therapy (TUMT), holmium laser ablation of prostate (HoLAP) and potassium-titanyl-phosphate (KTP) laser PVP) for symptomatic BPH were included. Transurethral PVP was performed using a GreenLight HPS™ side-firing laser system.

Results: Prior surgical management included TURP (18), TUMT (9), KTP laser PVP (8), HoLAP (2), TUMT and TURP (1), and TUMT and KTP laser PVP (1) in 39 of 181 consecutive patients. Mean prostate volume was 80.8 ± 50.0 mL. Mean laser and operative times and energy usage were 12.5 ± 10.5 minutes, 30.0 ± 24.0 minutes and 83.2 ± 64.4 kJ, respectively. Five patients developed a urinary tract infection. 36 patients had nonsignificant hematuria for less than one week. Three patients had persistent urinary retention requiring clean intermittent catheterization. No urethral strictures or urinary incontinence were noted. All patients were able to discontinue their prostate medications following surgery. Mean American Urological Symptom Association Score (AUASS) decreased significantly from 22.8 to 8.2, 6.5, 6.5, 5.5, 4.6, 3.6 and 4.6 (p<0.05) at 1 and 4 weeks and 3, 6, 12, 18 and 24 months, respectively. Mean maximum flow rate (Qmax) and post void residual (PVR) measurements also showed significant improvement from baseline. The incidence of adverse events were low.

Conclusion: Our initial results demonstrate that GreenLight HPS™ laser PVP is safe and effective for the treatment of symptomatic BPH recurring following prior surgical management.
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EARLY RESULTS OF ROBOTIC LYMPHADENECTOMY FOR RENAL CELL CARCINOMA
Gregory Lowe, Ryan Novak, Ronney Abaza
Ohio State University Medical Center & James Cancer Hospital

Introduction: Although laparoscopic nephrectomy has been performed for over 15 years and has become a standard treatment for renal cell carcinoma (RCC), lymphadenectomy (LAD) is rarely performed at the same time. There is little reported data regarding laparoscopic LAD for RCC with the largest reported series comprising only 50 cases, and the limited data does not support that an adequate node dissection can be performed. The role of lymphadenectomy (LAD) for renal cell carcinoma (RCC) is unclear as only 5% of patients are found to have nodal disease when clinically negative, and no survival advantage has been shown. Nevertheless, earlier identification of micrometastatic disease may become beneficial in the era of targeted molecular therapy such that the ability to perform an adequate LAD during minimally-invasive nephrectomy may become important. Robotics may improve the ability to perform an adequate LAD laparoscopically. We report our early results with robotic LAD for RCC.

Methods: Robotic LAD was performed in 26 patients with RCC by a single surgeon (RA), 24 who underwent radical and 2 who underwent partial nephrectomy. LAD was performed for tumors >4cm in size and for tumors with renal vein or vena caval tumor thrombus. For right-sided tumors, the LAD included paracaval, retrocaval, and interaortocaval nodes, and left-sided tumors included paraortic and interaortocaval nodes (Figure 1).

Results: Mean patient age was 57yrs (36-78) and mean BMI was 32kg/m² (22-54). Mean tumor size was 6.6cm. Only one had clinically enlarged nodes on preoperative imaging. Eleven tumors were advanced with 5 T3a and 6 T3b tumors, including 4 with vena caval tumor thrombi. Mean operative time was 202min (127-396min) overall and 181min excluding caval thrombi and partial nephrectomies with mean estimated blood loss of 68mL (10-200mL). A mean of 12.2 lymph nodes (4-31 nodes) was obtained with 1/26 patients (4%) found to have metastasis. Mean nodal yield from the first half to second half of cases rose from 10 to 15 nodes (p=0.03). Discharge was POD#1 in 92% and POD#2 in 8%. Eighteen of 26 cases were completed with ≤3 ports with additional ports for partial nephrectomy or IVC thrombectomy but no additional ports needed for the LAD. Complications included one asymptomatic lymphocele and a small bowel injury from an insulation defect in the cautery scissors tip cover repaired robotically.

Conclusions: Robotic LAD for RCC is feasible with reasonable operative times and an acceptable complication profile, but the rate of nodal positivity identified was low as expected. Increased nodal yield in later cases may reflect a learning curve. Higher nodal yield was obtained than in any of the limited published series with standard laparoscopy. Further study is needed to define the role LAD for RCC, but robotics appears to allow an adequate LAD to be performed in minimally-invasive fashion.

Figure 4: Completed right LAD with mobilized IVC and anatomic landmarks
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Jennifer L. Young, Elham Khanifar, Navneet Narula, Cervando G. Ortiz-Vanderdys, Surendra B. Kolla, Donald L. Pick, Petros Sountoulides, Oskar G. Kaufmann, Kathryn E. Osann, Victor B. Huynh, Adam G. Kaplan, Lorena A. Andrade, Michael K. Louie, Elspeth M. McDougall, and Ralph V. Clayman
University of California, Irvine

PARTIAL-VOLUME ARTIFACT ON PROSTATE ULTRASOUND IMAGING
Chien Ming Huang, Chunwoo Kim, Doru Petrisor, Doohyun Lee, Misop Han, Dan Stoianovici
Robotics Lab, Urology Department, Johns Hopkins University, Baltimore, MD

DYNAMIC REAL TIME MICROSCOPY OF THE URINARY TRACT: AN IMAGING ATLAS-BASED ON CONFOCAL LASER ENDOMICROSCOPY
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MRI-GUIDED PROSTATE BIOPSY ROBOT DEVELOPMENT
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