Engineering advances are continually resurfacing the face of medicine. It is incredible how rapidly new technology introduced into mainstream culture makes its way into medical practice. The EUS is a venue to present and discuss the latest tools and techniques to treat urologic pathology. The morning plenary session of the EUS meeting is structured to focus on an area of innovation and “late-breaking” news. It also serves as a forum where individuals from academia, industry and clinical practice can discuss challenges and formulate ideas for new approaches and tools.

The EUS will hold its 22nd annual meeting on Saturday May 19th, 2007 in Anaheim California. This year’s theme is innovative approaches in endoscopic surgery, directed by Dr Jean de la Rosette, Professor and Chairman at the AMC of the University of Amsterdam. The program includes sessions on current trends in endoscopic surgery including image assisted surgery and non invasive surgery via the trans-gastric approach. The European Society of Urology Technology session will highlight novel optical aids in nerve sparing prostatectomy and dynamic imaging. Raju Thomas MD Chairman of Urology at Tulane in New Orleans will direct the Robotics Working Group session where updates on the daVinci™ surgical system will be discussed. In the afternoon two poster sessions will permit open discussion of cutting edge methodology, procedures, and new instrumentation. These sessions have traditionally included papers in a variety of areas including robotics, video technology, chemical engineering, bioengineering, and computer science.

This year the web site of the EUS society [http://engineering-urology.org/](http://engineering-urology.org/) has been expanded with several new features reflecting the new structure of the society. The membership database has been updated with all the Endourology and EUS members and login access codes have been sent to all the members. The web-based paper submission and review site was also upgraded.

The review of the abstracts for the poster sessions was performed online by a group of 62 reviewers from around the world. Each paper received between 10 and 12 independent reviews. We would like to thank the reviewers, who are listed in this program, for their important contribution to this meeting.

The **Best Paper Award** was selected for the abstract with the highest review score average. The award goes to the “Notes Nephrectomy: Initial Laboratory Experience” paper of Dr. Ralph Clayman et. al. **Outstanding Paper Awards** are also presented to Dr. Troy Gianduzzo, Dr. Courtney Phillips, Dr. Mihir Desai, Dr. Georges-Pascal Haber, and their coauthors.

The society also presents Best Reviewer Awards for the online review process. A reviewer’s score for grading a paper is calculated based on the difference between his/her grade and the average grade of the paper, so that the score is higher for a closer match. Reviewer’s overall score sums up the scores of all the papers that he or she graded. We gratefully thank all reviewers for their contribution to the success of the meeting. Five reviewers have clearly distinguished themselves in this process not only through hard work but also by impressively objectively assigning the scores. The **Best Reviewer Awards** are presented to Dr. Thorsten Bach, Dr. Vincent Bird, Dr. Jean de la Rosette, Dr. Salvatore Micali, and Dr. Kevin Zorn.

The society welcomes all urologists, engineers, scientists from industry and academia to join us for this unique multi / interdisciplinary experience. It is through the sharing of many visions that our future will be shaped. Once again we are very thankful to Dr. George Nagamatsu, the founder and first president of the society for setting the foundations based upon which we meet.

Thank you for your continued scientific support,

Louis Kavoussi, MD  
Dan Stoianovici, PhD
CONTINUING MEDICAL EDUCATION

Method of Participation and Instructions for Claiming Credits
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Learning Objectives
At the conclusion of this medical education activity participants should be able to:
• Discuss novel technology to treat urologic pathology.
• Assess new urologic techniques and equipment.

Credit Designation
The American Urological Association Education and Research, Inc. designates this educational activity for a maximum of 7.5 AMA PRA Category 1 Credit(s)™. Physicians should only claim credit commensurate with the extent of their participation in the activity.

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Acknowledgement
The American Urological Association Education and Research, Inc. and the Engineering and Urology Society thanks the following companies for their support of this course: C.R. Bard, Inc., Percutaneous Systems, Inc., Astellas Pharma US, Inc.
# EUS 2007 PROGRAM

## ENGINEERING AND UROLOGY SOCIETY

*Saturday, May 19, 2007*

*Anaheim Marriott (Platinum Ballroom #2) Anaheim, CA*

*Program Chair: Jean de la Rosette*

*Co-Program Chair: Jens Rassweiler*

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229  In Vivo Expression of TGF-ß1 In Spinal Cord Injury Bladders And In Vitro Effects On Bladder Smooth Muscle Cell Contraction And Remodeling  
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228  In Vivo Expression of TGF-ß1 In Spinal Cord Injury Bladders And In Vitro Effects On Bladder Smooth Muscle Cell Contraction And Remodeling  
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230  The Effect Of Intraluminal Content On The Bursting Strength Of Vessels Ligated With Ultrasonic Shears  
Courtney Phillips

231  Does The Method Of Securing The Dorsal Venous Complex (DVC) During Robotic-Assisted Radical Prostatectomy Affect Apical Margin Rates: A Prospective Study  
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ABSTRACTS – Session 1

ABSTRACT 101

EARLY EXPERIENCE WITH OPTICAL COHERENCE TOMOGRAPHY (OCT) DURING MINIMALLY INVASIVE PROSTATECTOMY

Monish Aron, Jihad H. Kaouk, Nicholas J. Hegarty, Jose Roberto Colombo Jr, Georges-Pascal Haber, Benjamin I. Chung, Ming Zhou, Inderbir S. Gill

Section of Laparoscopic and Robotic Surgery, Glickman Urological Institute, Cleveland Clinic Foundation, Cleveland, Ohio

Objective: To evaluate the efficacy of optical coherence tomography (OCT) in the identification of the neurovascular bundle (NVB) during laparoscopic and robotic radical prostatectomy (LRP).

Materials and methods: Between 11/05 and 3/06, 24 patients treated with LRP were enrolled in this study. The Niris™ (Imalux Corporation, Cleveland, OH) OCT imaging system was deployed after division of the bladder neck. In vivo images were obtained to determine the image characteristics of NVB, adipose tissue, prostate capsule, and endopelvic fascia. The NVB was imaged again in vivo, after the prostate was excised. Ex vivo images were obtained from the prostate surface to look for presence or absence of nerve tissue and correlate with the surgeon’s assessment of the nerve sparing.

Results: OCT images of tissue structures were obtained in 24 patients. These images included endopelvic fascia, prostate capsule, NVB, fat, lateral pedicles, and lymphatics. The images were found to independently correlate with the surgeon’s impression of the tissue being imaged. Preliminary comparison with histology was performed in 4 patients, which suggested that OCT could help identify the NVB and prostate capsule during LRP (Figure 1).

Conclusions: OCT is able to satisfactorily image the NVB. This could enhance surgical precision during nerve sparing and positively impact potency outcomes after LRP. Further research is needed, including detailed histological correlation and potency outcomes, to validate the findings of OCT imaging.

Figure 1: Histopathological correlation of OCT imaging of nerve tissue
ABSTRACT 102

REVOLIX DUO—A NEW “WORKHORSE” IN UROLOGY?

Thorsten Bach (*), Thomas R.W. Herrmann (+), Andreas J. Gross (*)

*Asklepios Hospital Barmbek, Department of Urology, Rübenkamp 220, 22291 Hamburg, Germany
+ Medical College of Hannover, Department of Urology, Hannover, Germany

Introduction: The Ho:YAG laser in the 20 to 30 watt range is well established for the treatment of urinary calculi and incision of strictures. However, for the treatment of BPH, high-power Ho:YAG lasers in combination with additional instruments for tissue morcellation are needed. Alternatively for the treatment of prostate a separate laser system (e.g. KTP) had to be implemented. To overcome this cost-intensive investment for two urological lasers the RevoLix duo has been introduced. It combines a 20 Watt Ho:YAG laser, sufficient for stone therapy, with a RevoLix 2 micron 70 Watt cw laser for soft-tissue surgery.

Methods: Feasibility and safety of bladder neck incision (BNI) in patients with postoperative bladder neck contracture (BNC) (group A) and vaporesection of the prostate (group B) was studied. Both groups were followed for 12 months to identify durability of the results. A total of 14 patients with BNC were included in group A and 54 patients were included in group B. In group A, BNI was performed using the RevoLix Laser with a power set to 30 Watt and a reusable bare ended 365 µm fibre. In group B, vaporesection of the prostate was performed with the power set to 70 Watt, using a reusable 550 µm bare ended fibre. Vaporesection means simultaneous resection and vaporisation of the prostatic tissue.

Results:

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<tr>
<td>A</td>
<td>7</td>
<td>6.5 h (0–7.5 h)</td>
<td>9</td>
<td>23</td>
<td>2/14 (14.3%)</td>
<td>67 (55–78)</td>
<td>22</td>
<td>8</td>
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<tr>
<td>B</td>
<td>52</td>
<td>1.7 d (1–3 d)</td>
<td>4.2</td>
<td>20.1</td>
<td>30.3 cc (12–36)</td>
<td>61 (56–82)</td>
<td>19.8</td>
<td>6.9</td>
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</table>

Conclusion: Although the results on BNI and BPH treatment need longer follow-up, the RevoLix duo proved sufficient capabilities in the treatment postoperative bladder neck contracture and vaporesection of the prostate. For vaporesection of the prostate additional instrumentation for tissue morcellation is not needed. Reusable laser fibers significantly reduce the therapeutic cost per patient. Furthermore the treatment of stone disease is feasible. The combination of the well known Ho:YAG laser with the RevoLix cw-laser supersedes a second laser. Surgeon and assistance personnel need to be familiar with only one laser-system and its accessories, which eases daily use and allows better cost control.
ABSTRACTS – Session 1

ABSTRACT 103

HIGH ENERGETIC ESWL WITH WIDE FOCAL SPOT - ONE YEAR EXPERIENCE WITH SIEMENS LITHOSKOP®

Thorsten Bergsdorf, Christian Chaussy, Stefan Thueroff
Department of Urology, Krankenhaus Muenchen-Harlaching, Germany

Introduction: The DORNIER HM 3 represents the gold standard in lithotripsy for many urologists due to its excellent performance. New lithotripsy systems try to emulate the shockwave characteristics (wide focal spot and high shockwave energy) of this device to achieve comparable treatment results.

Methods: The SIEMENS Lithoskop® is a multifunctional lithotripsy system with the new electromagnetic shockwave system, Pulso™ (16 cm penetration depth, 8 – 12 mm energy dependent focal diameter), that enables the application of high shockwave energy (8 – 117 mJ) with low energy flux density. Stones are localized with inline-fluoroscopy or inline-ultrasound in under table— or over table—position of the shockwave source. 250 patients with stones in all areas of the urinary tract system were treated with the SIEMENS Lithoskop® since January 2006.

Results: 55 % of the stones were located in the kidney; the average stone size was 13 mm (5 – 35 mm). All treatments were performed under i.v. analgesia with alfentanil (av. dose 2.2 mg). 1,500 – 5,000 shockwaves (kidney: av. 2,850, ureter: av. 3,350) were applied in 15 - 55 minutes (kidney: av. 35 min., ureter: av. 40 min.) treatment time. Stone fragmentation could be achieved in all cases with shockwave energy < 80 mJ. 72 % of the patients have been judged stone free or with fragments < 3 mm, 21 % with fragments between 3 and 5 mm, 7 % with fragments > 5 mm in the control KUB/ultrasound after first ESWL-treatment. In total, 16 % of the patients needed additional ESWL-treatment, to achieve a fragmentation < 3 mm. Stone free rate was 85 % after one month (kidney 72 %, ureter 98 %) and increased to 88 % after 3 months (kidney 80 %, ureter 99 %). The most common complications were renal colics with 11 % and hydronephrosis with 7 %; one patient developed a subcapsular hematoma. 5 % of the patients needed auxiliary procedures for the treatment of ESWL-related complications.

Conclusion: High energetic ESWL with a wide focal spot proved to be highly effective and safe. The reduction of retreatment-rate without increase of side-effects / complications and the feasibility of treatment with i.v. analgesia makes ESWL a competitive treatment option for urinary stones in future.
ABSTRACT 104

DYNAMIC CONTRAST ENHANCED MRI WITH φTP IMAGE ANALYSIS FOR PROSTATE CANCER DETECTION

Rahuldev Bhalla¹, Michael Pollack², Joseph DiTrolio¹

¹ Division of Urology UMDNJ-New Jersey Medical School
² Department of Radiology – Montclair, NJ

Introduction: Prostate cancer is the most common cancer in men. The diagnosis of prostate cancer has been based on transrectal ultrasound and random prostatic biopsies. In 1989, to ‘standardize’ the technique of randomized prostate biopsies, Hodge et al. introduced the sextant biopsy, which was quickly adopted as the standard in the following decade. Most authors then reported a 20–25% positive biopsy rate but a false negative rate of up to 20–25%. This naturally resulted in the development of newer modalities to detect prostate cancer, specifically MRI. T2-weighted MR imaging has been used in the past but has been limited by unsatisfactory sensitivity and specificity for cancer detection. Dynamic contrast enhanced MRI has been used to characterize tumor microvasculature. The purpose of this study was to evaluate the diagnostic ability of dynamic contrast enhanced MRI with φTP image analysis (CAD Sciences, White Plains, NY).

Materials and Methods: We retrospectively reviewed 55 patient charts who underwent dynamic contrast enhanced MR imaging with φTP image analysis prior to transrectal prostate biopsy secondary to a PSA value > 4ng/dl or a prostatic nodule. Inclusion criteria include patients who have an elevated PSA without a prior diagnosis of prostate cancer. MR imaging was performed using a 3.0T system and were read by a single radiologist (MP). Transrectal ultrasound (TRUS)-guided biopsy was performed using an 18-gauge needle mounted on a spring-loaded commercial biopsy device.

Results: Of the 55 patient charts, only 33 met our inclusion criteria. The mean patient age was 62 years and the mean PSA was 7.9 ng/dl. There were 2 false negatives and 5 false positives for a sensitivity of 86% and specificity of 74% by dynamic contrast enhanced MRI with φTP image analysis.

Discussion: MR imaging remains the most promising technique for the detection and staging of prostate cancer despite its current sensitivity and specificity limitations. Generally, T2-weighted imaging, which yields excellent anatomic images of the gland but the detection and localization of prostate cancer within the prostate by T2-weighted imaging is limited, which means that prostate cancer cannot be distinguished from other T2-hypointense lesions, such as prostatitis, hemorrhage, dystrophic changes related to radiation, or androgen-deprivation therapy. Dynamic contrast enhanced MRI with φTP image analysis is based on visualization using all time points in the MRI series. With a series of pharmacokinetic calculations, the areas that are suspicious for cancer are assigned a red color hue. By using dynamic contrast enhanced MRI we were able to localize prostate cancer with an 86% sensitivity and 74% specificity. Additional controlled studies will be required to validate the potential clinical applications of this technique including possible tumor localization for biopsy.
PRECISION INJECTION MOLDING WITH BEGO STONE AND ULTRACAL 30 FOR THE PREPARATION OF ARTIFICIAL KIDNEY STONES OF REPRODUCIBLE SIZE, SHAPE AND MASS

Robert I. Carey MD PhD, 1 Donna L. Carey MD, 1 Christopher C. Kyle MD, 2 Vincent G. Bird MD, 2 and Raymond J. Leveillee 2

1Urology Treatment Center, Sarasota FL and 2Department of Urology, University of Miami, Miami FL

Purpose: Ideal model lithotripsy experiments require artificial kidney stones that are the same size, shape and mass. Bego stone and UltraCal-30 have been validated as having acoustic and lithotripsy properties similar to calcium oxalate stones. Current methods for stone preparation using these materials are limited by several factors, including size or shape restrictions, toxic solvents requiring hazardous disposal, post-production processing or cumbersome, resource-intensive techniques.

We present a convenient, environmentally sound process that can produce stones of any size, shape, or mass in a precise, reproducible manner using either UltraCal-30 or Bego stone. This process can be performed without the need for access to a formal laboratory or the need to purchase and dispose of hazardous waste.

Materials and Methods: First, a calcium alginate and silica based mold is created. Objects of the desired size and shape are loaded onto a grid and pressed into the mold. Once a cast is created, UltraCal-30 cement or Bego Stone is injected and allowed to harden. After harvesting, the stones are weighed and the densities calculated for a variety of shapes. Also, ex vivo and in vivo laser lithotripsy is performed with a holmium laser.

Results: The masses of the UltraCal-30 stones were: 0.661 +/- 0.0284 grams for large spheres; 0.046 +/- 0.0024 for small spheres, and 0.752 +/- 0.0180 for hexagons (95% confidence intervals). Equally precise results were obtained for Bego stone. The density of the stones was consistent for various shapes and in the range for published values. Ex vivo and in vivo laser lithotripsy comminuted the artificial stones in a manner similar to normal stones and to published lithotripsy studies using these materials.

Conclusions: We present a convenient, environmentally sound preparation of artificial kidney stones formed from UltraCal-30 or Bego stone in a biodegradable calcium alginate-based silica mold. This technique yields predictable and reproducible stones in a variety of shapes and sizes.
ABSTRACT 106

ESWL OF PEDIATRIC UROLITHIASIS – 10 YEARS’ EXPERIENCE WITH ELECTROMAGNETIC SHOCKWAVE SYSTEMS

Christian Chaussy, Thorsten Bergsdorf, Stefan Thueroff
Department of Urology, Krankenhaus Muenchen-Harlaching, Germany

Introduction: Urolithiasis in childhood is very rare, but the therapy has been challenging, until today. We reviewed our pediatric ESWL-treatments of the last 10 years to determine the efficacy and safety of this noninvasive treatment option.

Methods: Between 08/1996 and 08/2006, 70 children (0 -16 years) were treated with ESWL. All treatments were performed on two electromagnetic lithotripsy systems (SIEMENS Lithostar Multiline / SIEMENS Lithostar Modularis) under general anaesthesia or i.v. analgosedation.

Results: 38 boys and 32 girls with an average age of 7.4 years (49 % < 7 years) received in total 106 ESWL-treatments. One-third of the children were recurrent stone formers; 17% had additional renal/congenital anomalies. 75 % of the stones were located in the kidney; av. stone size was 10 mm. Treatment time was between 20 and 130 minutes (av. 45 min.), children until 12 years were treated in general anaesthesia (74 %), 6 children were treated bilateral in one ESWL-session under GA. The retreatment rate was 30 % with an average of 1.5 ESWL/patient. All patients with ureteric calculi and 79 % with renal stones were rendered stone free after 3 months. The stone free rate for kidney stones reduced to 36 % in children with additional renal/congenital anomalies (90 % SF-rate without anomalies), but all patients became symptom free. 16 % of patients had to undergo auxiliary procedures before ESWL, but only 1 child required a percutaneous nephrostomy after shockwave-therapy.

Conclusion: Extracorporeal shockwave lithotripsy is the treatment modality of first choice for pediatric urolithiasis, because of its efficacy, safety and noninvasiveness. Endoscopic measures are only necessary in case of big stone mass or accompanying renal/congenital anomalies.
NOTES NEPHRECTOMY: INITIAL LABORATORY EXPERIENCE

Ralph V. Clayman\textsuperscript{1}, Geoffrey N. Box\textsuperscript{1}, Jose Benito A. Abraham\textsuperscript{1}, Hak J. Lee\textsuperscript{1}, Leslie A. Deane\textsuperscript{1}, Eric R. Sargent\textsuperscript{1}, Ninh T. Nguyen\textsuperscript{2}, Kenneth Chang\textsuperscript{3}, Amy Tan\textsuperscript{3}, Lee E. Ponsky\textsuperscript{4} and Elspeth M. McDougall\textsuperscript{1}

\textsuperscript{1}Department of Urology, \textsuperscript{2}Department of Surgery, \textsuperscript{3}Department of Medicine, Division of Gastroenterology, University of California, Irvine, CA
\textsuperscript{4}Department of Urology, University Hospitals Case Medical Center, Cleveland, OH

Introduction: The development of the contemporary endoscope has allowed surgeons to change the treatment paradigm in a multitude of diseases and now this role is being further expanded, challenging our preconceived limitations. Abdominal surgery is now being approached via existing body openings, thus leaving the patient without an external incision. Natural Orifice Transluminal Endoscopic Surgery (NOTES) has been recently introduced into the gastrointestinal surgical armamentarium. This approach has shown initial success with several transgastric procedures; however it has never been reported in urologic surgery. Herein we present our initial experience with a transvaginal, one port, NOTES nephrectomy.

Methods and Results: An acute experiment was performed in a 45 kg female farm pig. Pneumoperitoneum was obtained with a Veress needle and a single 12mm trocar was placed in the midline just below the umbilicus. A ShapeLock TransPort\textsuperscript{TM} Multi-lumen Operating Platform (USGI Medical, San Clemente, CA) was used to perform the transvaginal procedure. This device has four working channels and is flexible until it becomes rigid once it is locked into position, creating a multitasking platform that allows two-handed tissue manipulation. The ShapeLock TransPort\textsuperscript{TM} device was introduced into the vagina, and using a combination of laparoscopic and endoscopic guidance, transvaginal peritoneal access was obtained using an endoscopic needle knife, and a sphincterotome. The dissection began inferior to the kidney and proceeded superiorly until the ureter and hilum were isolated. This was done with a combination of the endoscopic needle knife and a tissue grasper for retraction. Via the 12 mm port, the renal artery and vein were taken separately with a vascular EndoGIA and standard laparoscopic titanium clips, respectively; the ureter was similarly clipped and divided. Retraction was also delivered through the USGI TransPort\textsuperscript{TM} using a specially designed tissue acquisition device (g-Prox\textsuperscript{TM} (USGI Medical, San Clemente, CA)). At any given time, at least two instruments plus the endoscope were deployed via the transvaginal USGI platform. The kidney was placed into a 10mm EndoPouch retriever and was removed intact via the vagina. Total operative time was 300 minutes.

Conclusion: Transvaginal NOTES nephrectomy can be accomplished in a porcine model. Additional testing on survival animals is necessary to validate this approach. A new frontier in minimally invasive renal surgery may be upon us, one in which the surgeon creates no new visible scars on the patient. While intriguing, and novel, we hypothesize that an approach of this nature may one day play a role in the realm of donor nephrectomy.
ABSTRACT 108

A FLEXIBLE CYSTOURETHROSCOPE CONTINUOUS FLOW SYSTEM: TIME REQUIRED TO A CLEAR VISION PATH IN A BLADDER MODEL

Bela S. Denes, MD,
Laguna Beach, CA

Introduction: A flexible cystoscope continuous flow system has been developed using an introducer sheath, and in a small series of patients it has provided the means to perform bladder biopsy in the office. However, the degree to which this system can clear the field of view has not been quantified. The objective of this study was to determine the speed and level of clarity that can be provided by using this system.

Methods: A bladder model was constructed from acrylic with a volume of 400 cc in order to assess the rapidity with which a change in visibility occurs with the continuous flow setup. The model contained an opening to accommodate placement of a 23 Fr introducer sheath (Cystoglide Introducer Sheath, PercSys, Inc) and a 17 Fr flexible cystoscope (ACMI), as well as an opening in the bottom of the model through which a slurry of colored liquid, which mimicked blood, could be introduced into the artificial bladder. The flexible cystoscope continuous flow setup consisted of inflow of water via standard tubing attached to the working channel of the flexible cystoscope from a reservoir at a height of 90 cm above the bladder and outflow via standard tubing attached to the side port of the urethral introducer. The artificial blood was slurry composed of two parts chocolate to three parts strawberry ice cream syrup. The flexible cystoscope was introduced into the artificial bladder via the lumen of the introducer sheath and manipulated so that it was looking down on the base of the bladder model, with its light shining toward the base of the model at a distance of 2 cm. Next a photovoltaic cell was attached to the eyepiece of the flexible cystoscope so that the amount of light (in volts) transmitted via the eyepiece could be measured with an oscilloscope. The photocell and eyepiece of the flexible cystoscope were encased in a light-barrier sack so that ambient light was not included in the measurement. In a darkened room, the bladder model was filled two-thirds with water and a baseline measurement of the voltage when looking into the clear fluid was taken for 60 seconds. Next, 4 cc of the artificial blood were introduced between the tip of the cystoscope and the base of the bladder model and the voltage measured for 5 seconds. Finally, the continuous flow procedure was started and continued until the voltage returned to the baseline measurement. The voltage of the cell was captured at one-tenth second intervals and recorded onto an electronic worksheet. The mean time to return of the voltage to baseline was determined from five repetitions.

Results: Introduction of the artificial blood decreased the voltage measured, and hence the visibility, by 70% and resulted in a near-total obscuring of the field of view of the cystoscope, but within a mean of 3 seconds (range 2 to 3 seconds) after beginning the continuous flow procedure, the amount of light present in the field of view returned to baseline readings.

Conclusion: The continuous flow setup with a 17 Fr cystourethroscope advanced via a urethral introducer sheath with an internal diameter of 19 Fr resulted in rapid clearing of the field of view when presented with a simulated bleeding response to bladder biopsy. This rapid clearing, in addition to the ease of use of this set up in the office environment, can facilitate the transition of certain operative procedures that benefit from continuous flow into the office setting.
ABSTRACT 109

SUTURELESS LAPAROSCOPIC HEMINEPHRECTOMY: SAFETY AND EFFICACY IN PHYSIOLOGIC AND CHRONICALLY OBSTRUCTED PORCINE KIDNEY

Ithaar H. Derweesh, M.D., John B. Malcolm, M.D., Christopher DiBlasio, M.D., Reza Mehrzarin, M.D., and Scott Jackson, D.V.M.

Departments of Urology and Comparative Medicine, University of Tennessee Health Science Center, Memphis, TN

Introduction: Widespread application of laparoscopic partial nephrectomy has been limited by potential for collecting system entry requiring sutured repair with prolonged warm ischemic time. We sought to develop a streamlined sutureless system of repairing large parenchymal and collecting system defects using BioGlue (bovine albumin-glutaraldehyde adhesive) and ProPatch (bovine pericardial patch) in the porcine model under physiological conditions and mechanical stress imposed by chronic ureteral obstruction.

Methods: 4 pigs (8 kidneys) underwent left-side transperitoneal laparoscopic heminephrectomy, followed two weeks later by right-sided heminephrectomy with ureteral transection to provide a mechanical stressor on the repair, followed two weeks later by euthanasia. In each case, after hilar clamping, the lower pole is removed with the Trisector-bipolar dissector (GYRUS). Hemostasis was obtained with argon beam coagulator (Conmed) and FloSeal (thrombin-gelatin matrix), followed by sutureless repair. At euthanasia, harvested renal remnants undergo ex vivo retrograde-pyelography and histopathological examination to rule out urinoma/perinephric fluid collection and to determine collecting system and parenchymal healing.

Results: Mean operative time was 77.3 minutes. Mean warm ischemia time was 13.3 ± 6.7 minutes. Estimated blood loss was 42.1 ± 39.7 cc. Mean weight of resected specimen was 12.3 ± 3.2 g. All 8 animals demonstrated immediate hemostasis on hilar clamp release. Pyelography failed to demonstrate any collecting system leakage, and closure and healing was confirmed by in all. 2 pigs were euthanized for causes unrelated to procedures 4 days prior study end.

Conclusion: Sutureless repair of laparoscopic heminephrectomy defects is safe and efficacious in physiological and chronic obstructive conditions in swine. The procedure is reproducible and resection/renorrhaphy was completed on average in less than 14 minutes warm ischemia time.
<table>
<thead>
<tr>
<th>Variable</th>
<th>Left side (physiologic) N= 4</th>
<th>Right side (obstructed) N = 4</th>
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<tr>
<td>Mean Preop</td>
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<td>Serum Creatinine (mg/dL)</td>
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<td>Mean Preop</td>
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<td>0.356</td>
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<tr>
<td>Mean POD 14/pre-euthanasia</td>
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<td>2.1 ± 1.4</td>
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<td>Renal Remnant wt (gm)</td>
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**Source of Funding:** Educational grant from CryoLife, Inc. (Kennessaw, Georgia, USA).
FLEXIBLE ROBOTIC RETROGRADE RENOSCOPY:
DESCRIPTION OF A NOVEL ROBOTIC DEVICE AND PRELIMINARY LABORATORY EXPERIENCE

Mihir M. Desai¹*, Monish Aron¹, Inderbir S. Gill¹, Georges Pascal-Haber¹, Osamu Ukimura¹, Jihad H. Kaouk¹, Gregory Stahler², Federicio Barbagli², Christopher Carlson², Fredric Moll²

Glickman Urological Institute, Cleveland Clinic Foundation, Cleveland, OH,¹ and Hansen Medical, Mountain View, CA²

Aims: To describe a novel flexible robotic system for performing retrograde renoscopy.

Materials and Methods: Remote robotic retrograde flexible renoscopy was performed bilaterally in 5 acute swine (10 kidneys). A novel 14F robotic catheter system (Hansen Medical, Mountain view CA), which manipulated a passive optical fiberscope mounted on a remote catheter manipulator, was employed. The technical feasibility, efficiency, and reproducibility of accessing all calices were assessed. Laser lithotripsy of calculi and laser ablation of renal papillae were also performed.

Results: The robotic catheter system could be introduced de novo in 8 ureters; 2 ureters required prior dilation. The ureteroscope could be successfully manipulated remotely into 83 of the 85 calyces (98%). Time for inspecting all calyces within a given kidney decreased from 15 minutes to 49 seconds (mean 4.3 min) with increasing experience. On a visual analog scale of 1-10 (1= worst, 10= best), reproducibility of caliceal access was rated 8, and stability of the instrument tip within the desired calix was rated 10. Perforation of the renal pelvis (n=1) constituted the only complication. Histology of the ureter showed changes consistent with acute dilation without areas of necrosis.

Conclusions: A novel robotic catheter system for retrograde renoscopy is described. Evaluation in the acute animal model revealed the following potential advantages over conventional manual flexible uretero-renoscopy: increased range of motion, instrument stability and fixity of position, and improved ergonomics. Ongoing refinement of this initial prototype is likely to expand the role of retrograde intra-renal surgery in the near future.

Figure 1. Simultaneous fluoroscopic and endoscopic view seen by the surgeon seated at the workstation. The catheter animation provides a visual clue about the direction the catheter tip is attempting to take.
ENDOSCOPIC TREATMENT OF CATHETERIZABLE STOMAL INCONTINENCE WITH INJECTION OF A BULKING AGENT

Ben Donovan MD, Jeremy Tonkin MD, Dominic Frimberger MD, Jeffrey Campbell, MD, Brad Kropp MD

Department of Urology, University of Oklahoma Health Sciences Center, Oklahoma City, OK

**Purpose:** Urinary and fecal continence can be achieved by constructing catheterizable stomas for urinary or fecal control. While overall satisfaction with continence mechanisms is high, some patients develop persistent stomal leakage. A minimally invasive method of injection with a bulking agent for treatment of stomal incontinence was evaluated.

**Materials and Methods:** A retrospective review was performed in patients with incontinence of their catheterizable continent urinary stoma (CUS) and/or fecal stoma (ACE). Stomal incontinence was defined as any leakage of urine or stool from the stomas. All patients underwent endoscopic submucosal stomal injection with a bulking agent. Endoscopic injection took place at the level of the continent valve in the 12, 3, 6 and 9 o’clock position. The procedure, materials injected, number of procedures required and success was evaluated.

**Results:** Out of 157 patients with a CUS and/or ACE followed in our institution between 1996 and 2007 (total of 164 stomas), 8 patients underwent minimally invasive therapy with injection of a bulking agent into the stoma (total of 9 stomas). The procedure initially performed was appendicovesicostomy in 1 patient (ACUS), ileovesicostomy (Monti) in 7 patients, and ACE in 2 patients. Amount of bulking agent injected varied between 1.4 cc to 7 cc (mean 4.0 cc). Follow up ranged from 1 to 39 months (median 15 months). Two patients received multiple injections. One patient had injection of both ACUS and ACE. Two patients underwent minor surgical correction for stenosis of the stoma at the same time as injection therapy. Seven of nine stomas were continent at last follow-up, 6 of 7 (86%) of CUS and 1 of 2 (50%) of ACE, for a success rate of 78%.

**Conclusion:** Stomal incontinence is an infrequent but troublesome complication often requiring multiple surgeries to achieve continence. As many of these patients have had multiple intra-abdominal procedures, minimally invasive treatment with injection of a bulking agent provides an excellent alternative in achieving stomal continence.
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TOWARDS DEVELOPMENT OF A UROLOGICAL TISSUE CHARACTERIZATION DATABASE

Nicholas J. Ellering\textsuperscript{1}; Gerald W. Timm, PhD\textsuperscript{1}; Robert Sweet, MD\textsuperscript{1}; Arthur G. Erdman, PhD\textsuperscript{2}

\textsuperscript{1}Department of Urologic Surgery, University of Minnesota
\textsuperscript{2}Mechanical Engineering Department, University of Minnesota

Introduction: Numerous devices are currently on the market for the treatment of urinary incontinence. These devices have varying success rates depending on the method of treatment. The need for treatment of urinary incontinence may be reduced by gaining an understanding of the underlying causes of the ailment. A computer simulated injury model will be created to help determine whether forces on the body from specific physical activities are a cause of urological tissue damage leading to future urinary incontinence problems. To develop an accurate injury model, the mechanical properties of the tissues in the lower urinary tract need to be determined. A tissue characterization database is being completed by performing uniaxial tensile testing on urological tissues.

Methods: A picture of a specimen under uniaxial tension is shown. Tissues are extracted from cadavers within 24 hours post mortem. The specimens are immediately placed in physiological solution for storage. The tissues are cut into narrow strips (approximately 3 mm wide by 1 mm thick by 30 mm long) and heated to physiological temperature. After being placed on the uniaxial tensile machine, each tissue is subjected to 10 preconditioning cycles. Afterwards, the tensile test is conducted.

Results: Preconditioning is completed to prepare the tissues for tensile testing by ensuring that the tissues have reached a steady state. Numerous tests have found that 10 preconditioning cycles is adequate for ensuring that the urological tissues being tested are in a steady state. A plot showing a bladder wall specimen approaching steady state is shown. Tissues from 3 human cadavers have been tested to date. A stress-strain curve of bladder wall from an 18 year old female is shown. Constitutive equations can be written from the relationships shown on the stress-strain curves. Tests are also being conducted to determine the type of constitutive model to be used. Stress relaxation tests have shown that most urological tissues exhibit the relaxation function characteristics of a standard linear solid.

Conclusion: The stress-strain relationship of urological tissues is nonlinear. If the relationship were strictly linear, a single value for the elastic modulus of the tissue could be determined. Since the slope of the line is constantly changing, more complex constitutive equations need to be determined to accurately model the elastic modulus of lower urinary tract tissues. The constitutive equations and the Poisson’s ratio can be entered into a finite element injury model to determine the forces needed to cause plastic deformation of the urological tissues. This injury model should help researchers and physicians pinpoint direct causes for injury-related urinary incontinence.
INTRODUCTION: We present a novel multimedia enhanced method of poster presentation during scientific meetings and assess its impact on the scientific and logistic aspect. To our knowledge this Virtual “V”-poster format is the first ever in scientific conferences.

METHODS: We utilized the “V”-poster format for the best 300 poster presentations at the recent 24th World Congress of Endourology in Cleveland. Fifty, 42” high definition flat LCD display monitors were mounted on individual upraised trusses. Capability was created to project any “V”-poster image on 2 large (12*10 feet) screens. Each poster was created according to a predetermined template with picture-in-picture inclusion of pertinent videos/animation. All “V”-posters were uploaded on a dedicated FTP server. Each submitted “V”-poster was reformatted, backed-up and reversed to ensure standardized fluidness of presentation. An email survey was sent to all attendees.

RESULTS: Of the 300 “V”-posters accepted, 285 (95%) were submitted online. These 285 “V”-posters were presented in 12 separate 2hrs moderated sessions, over a period of 3 days. All “V”-posters were displayed on the individual LCD screen for the full 2 hrs and projected on the large screens during the 3 min presentation. All individual LCD and giant screen presentations were executed without any technical/electronic malfunction and all the sessions were completed on time. Survey response was received from 524 attendees. The presenters felt they spent less, same or more time to prepare a “V”-poster compared to a standard poster in 57.5%, 18.4% and 24.1%, respectively. 94.1% of the attendees and 100% moderators believe that “V”-poster attracted more people. 94.2% of the moderators felt that it is more efficient to moderate a “V”-poster session. Overall, 97% of responders opined that “V”-poster provides additional information that enhances the scientific presentation, and 85% would like to see all future poster presented in a “V”-poster format.

<table>
<thead>
<tr>
<th></th>
<th>Virtual-Poster</th>
<th>Printed-Poster</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time spent to create a poster (hours)</td>
<td>4.5 (0.5-15)</td>
<td>5.6 (1-22)</td>
<td>0.03</td>
</tr>
<tr>
<td>Cost to create a poster (USD)</td>
<td>5.2 (0-80)</td>
<td>107 (10-300)</td>
<td>&lt;0.0005</td>
</tr>
<tr>
<td>Number of session attended per attendees (n)</td>
<td>5.3 (1-12)</td>
<td>3.5 (1-12)</td>
<td>&lt;0.0005</td>
</tr>
<tr>
<td>Number of Posters viewed (n)</td>
<td>11.7 (1-20)</td>
<td>5.7 (1-20)</td>
<td>0.01</td>
</tr>
<tr>
<td>Time spent in each session (min)</td>
<td>38.5 (5-120)</td>
<td>12.4 (5-120)</td>
<td>&lt;0.0005</td>
</tr>
</tbody>
</table>

**Rate of Poster session on a scale of 0 to 10 (0 = fair – 10 = excellent)**

<table>
<thead>
<tr>
<th></th>
<th>Virtual-Poster</th>
<th>Printed-Poster</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attendees (n=423)</td>
<td>8.58</td>
<td>5.40</td>
<td>&lt;0.0005</td>
</tr>
<tr>
<td>Presenters (n=85)</td>
<td>8.91</td>
<td>4.34</td>
<td>&lt;0.0005</td>
</tr>
<tr>
<td>Moderators (n=16)</td>
<td>9.82</td>
<td>3.29</td>
<td>&lt;0.0005</td>
</tr>
</tbody>
</table>

*All data presented as mean (range)*
Conclusion: Our survey indicated that our novel Virtual “V”-posters presentation were strongly attended and enhance scientific communication. It is likely that this electronic formatted poster will be the method of choice of poster presentation in future.
EXTENDED PELVIC LYMPHADENECTOMY DURING ROBOTIC CYSTECTOMY

Jason Hafron, Jihad H. Kaouk George-Pascal-Haber, Bruno R. Santos, Roberto R.Columbo, Jr. Monish Aron, Robert J. Stein, Mike Nguyen, Steven C. Campbell and Inderbir S. Gill

Introduction and Objectives: To compare the techniques and outcomes of a limited and extended pelvic lymphadenectomy during robotic radical cystectomy.

Methods: Between March 2005 and November 2006, 14 patients underwent robotic radical cystectomy with extracorporeal urinary diversion. A limited pelvic template was performed in 6 patients and an extended pelvic template was performed in the 8 patients. Anatomical boundaries of the limited pelvic template included the external iliac vein laterally, the obturator nerve medially, the pubic bone distally and the bifurcation of the common iliac artery proximally. For an extended pelvic dissection anatomical boundaries included the genitofemoral nerve laterally, the obturator nerve posteriorly, the bladder medially, the node of Cloquet distally and the aortic bifurcation proximally. Modifications in our technique when performing an extended dissection included, placement of our primary 12 mm. camera port and 8mm working robotic ports 2-3 cm cephalad to our standard port placement and significant proximal mobilization of the ureter.

Results: With an extended template the mean number of lymph nodes retrieved was 21.1 ± 5.4 (range 11 to 29) and 7.3 ± 2.8 (range 2 to10) for the limited lymphadenectomy was significantly different (p =0.0003). Positive lymph nodes were found in one patient that underwent an extended lymph node dissection. A comparison of the number of nodes retrieved from an extended lymph node dissection and limited dissection, respectively, from the right pelvic side (11.6±3.1 and 4.3± 2.2) and left pelvic side (8.6± 2.8 and 3.0 ±1.3) was not significantly different (p=0.08 and p=0.28). An extended lymphadenectomy added an additional 40 minutes to the total operative time. One patient undergoing a limited lymphadenectomy sustained an obturator arterial injury managed by re-exploration.

Conclusions: With minor modifications of robotic techniques an extended pelvic lymphadenectomy can be performed with nodal yield and anatomical boundaries that mirror open surgical outcomes.
THE EFFECTS OF CULTURE CONDITIONS AND IMPLANTATION ON THE STRUCTURAL AND MECHANICAL CHARACTERISTICS OF A TISSUE ENGINEERED URETHRAL WRAP

Donna J. Haworth¹,²,⁴, Douglas W. Chew²,⁴, Minoru Miyazato³, Dae Kyung Kim³, Naoki Yoshimura³, Michael B. Chancellor³,⁴, and David A. Vorp¹,²,⁴
University of Pittsburgh Departments of ¹Bioengineering, ²Surgery, and ³Urology and the ⁴McGowan Institute for Regenerative Medicine, Pittsburgh, PA

Introduction: Urinary incontinence associated with urethral dysfunction often accompanies several clinical conditions, such as spinal cord injury, diabetes, and stress urinary incontinence (SUI). SUI is an especially common condition in women following vaginal delivery in childbirth. There are currently several treatments for SUI, each accompanied by limited effectiveness and/or complications¹-³. Regenerative medicine techniques applied to the native urethra may aid in improving the function of the urethra in SUI and other conditions. We have begun developing a tissue engineered urethral wrap (TEUW) for placement around and support of the native urethra. The goal of this work was to determine optimized culture conditions for TEUWs and to determine if their use in vivo improves urethral function.

Methods: TEUWs were fabricated by molding a fibrinogen, thrombin and a bone marrow progenitor cell mixture into a tube. Post-gelation, constructs were cultured in a spinner flask for 5 or 10 days, or 5 days in the spinner flask followed by 5 days in a bioreactor perfusion system. The construct length, cell content via the MTT assay, compliance (C) and burst pressure (BP)⁴, and histological appearance were assessed. For in vivo studies, an established rat model of SUI was employed. TEUWs were fabricated and cultured in a spinner flask for 5 days. At the end of the culture duration, 2 groups of female Lewis rats received a bilateral transection of the pudendal nerves and separation of the urethra from the surrounding tissue; one group received TEUW placement around the proximal portion of the urethra. Leak point pressure (LPP) was assessed 7 days post-implantation.

Results: TEUW BP increased, while C and cell metabolic activity decreased with increased culture duration. Perfusion culture produced constructs with C and BP closest to that of a native urethra. H&E staining indicated that cells within constructs exposed to spinner flask culture migrate toward the outer surface of the construct, while those perfused had a uniform distribution through the thickness. In vivo studies showed a slight increase in LPP of urethras with the TEUW in place, suggesting that the TEUW provides support to the diseased urethra.

Conclusion: This study demonstrates our ability to construct and culture tubular-shaped constructs for use as a TEUW for the potential treatment of urethral dysfunction SUI. Our data suggests that placement of a TEUW in vivo improves function of the native urethra in a rat model of SUI.


Acknowledgements: Funding provided by: NIH/NIBIB 5T32EB001026-03 and NIH/NIBIB R21 EB006318.
APPRAISAL OF A NOVEL PROCEDURE: POTASSIUM TITANYL PHOSPHATE (KTP) LASER LAPAROSCOPIC PARTIAL NEPHRECTOMY

D Hodgson, D Karamanolakis, K Rajbabu, M Graziano, J Poulsen, G Muir, P Grange

Department of Urology, King’s College Hospital Foundation Trust, London

Introduction: We have previously reported our experience in developing the technique of using KTP laser energy to perform partial nephrectomy on the pig model. We found that the procedure was feasible with negligible blood loss obviating the need for vessel clamping, and with minimal disturbance to the resection margins histologically (Liu et al. J Endourol 2006; 20(12):1096-100, Hindley et al. Urology 2006; 67(5):1079-83). We now report our early experience in humans.

Material and Methods: We treated two male patients in February 2007. A trans peritoneal route was employed, the kidney fully mobilized, and the artery looped and clamped when resecting near the hilum. Neither patient required a stent. Parameters studied include anesthetic time, energy used, laser time, hospital stay, PCV/Haemoglobin drop (by day 2), change in renal function (by day 2), histological stage and short term complications. Both procedures were digitally recorded and an edited film produced.

Results:

<table>
<thead>
<tr>
<th></th>
<th>Patient 1</th>
<th>Patient 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>57</td>
<td>53</td>
</tr>
<tr>
<td>Anesthetic time</td>
<td>51/2 hrs</td>
<td>4 hrs</td>
</tr>
<tr>
<td>Laser setting (Watts)</td>
<td>40-60</td>
<td>40-60</td>
</tr>
<tr>
<td>Energy used (Joules)</td>
<td>55,228</td>
<td>33,813</td>
</tr>
<tr>
<td>Laser time (min)</td>
<td>45</td>
<td>30</td>
</tr>
<tr>
<td>Arterial occlusion (min)</td>
<td>21</td>
<td>17</td>
</tr>
<tr>
<td>Drain removed day</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Drainage (ml)</td>
<td>100</td>
<td>145</td>
</tr>
<tr>
<td>Stay- post-op days</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>PCV drop (l/l)</td>
<td>0.072</td>
<td>0.056</td>
</tr>
<tr>
<td>Hb drop (g/dl)</td>
<td>2.3</td>
<td>2.2</td>
</tr>
<tr>
<td>Creatinine rise (umol/l)</td>
<td>5</td>
<td>25</td>
</tr>
<tr>
<td>Histological stage</td>
<td>T1b (5cm), margins clear</td>
<td>T1a, margins equivocal (specimen cut in theatre)</td>
</tr>
<tr>
<td>Complications</td>
<td>Nil</td>
<td>Nil</td>
</tr>
</tbody>
</table>

Conclusion: We have demonstrated successful transference of this novel operation from animal model to two patients, in terms of blood loss, safety and the absence of short-term complications. We intend to complete a closely monitored series of 10 cases before considering whether it compares favourably with existing methods for resection in laparoscopic partial nephrectomy.
CONTENT AND FACE VALIDITY OF A COST-EFFECTIVE PERSONAL LAPAROSCOPIC TRAINER DESIGNED FOR AT HOME USE

Gregory W Hruby*, New York, NY; Corollos Abdelshehid, Elspeth M McDougall, Ralph V Clayman, Orange, CA; Jaime Landman, New York, NY

Introduction and Objective: We present our experience, including the design and the initial evaluation of an affordable, and portable laparoscopic training system known as the EZ trainer. The face and content validity were assessed for the EZ trainer System.

Methods: The EZ trainer system utilizes a webcam to provide the optical signal while the trainee supplies their own laptop or desktop computer to process the optical signal and act as the viewing monitor. At the 2006 Society of Laparoendoscopic Surgeons meeting, various surgeons and biotechnology representatives evaluated the EZ trainer with a questionnaire.

Results: Among 42 participants, 96% rated the EZ trainer as a realistic laparoscopic training format (Table 1). Of the 42 participants, 27 performed greater than 30 laparoscopic cases per year; 81.5% of these experienced laparoscopists rated the EZ trainer as comfortable to use, 92.6% found the EZ trainer to be a realistic practice format, 70.4% would purchase the EZ trainer for personal use, and 85.2% would recommend the EZ trainer be made available to surgical residents in their discipline. Among 15 novice laparoscopists (i.e. < 30 laparoscopic cases/yr.), 87% rated the EZ trainer as comfortable to use, 93.3% found the EZ trainer to be a realistic practice format, 73.3% would purchase the EZ trainer for personal use, and 80% would recommend the EZ trainer be made available to diverse surgical residents.

Conclusions: The EZ trainer system has both face and content validity. Both personnel with and without expert laparoscopic experience found it to be an efficient and realistic laparoscopic training device.

<table>
<thead>
<tr>
<th>Validity Questionnaire Response</th>
<th>Genreal Surgeon (15)</th>
<th>Gynecologist(8)</th>
<th>Urologist(10)</th>
<th>Other(9)</th>
<th>Total (42)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is the EZ Trainer Comfortable</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>35</td>
</tr>
<tr>
<td>Yes</td>
<td>12</td>
<td>7</td>
<td>8</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>Is this a good practice format?</td>
<td>15</td>
<td>7</td>
<td>9</td>
<td>8</td>
<td>39</td>
</tr>
<tr>
<td>Yes</td>
<td></td>
<td>7</td>
<td>9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Satisfactory needle holders?</td>
<td>12</td>
<td>5</td>
<td>9</td>
<td>8</td>
<td>34</td>
</tr>
<tr>
<td>Yes</td>
<td></td>
<td>5</td>
<td>9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>Similar Trainer image to Laparoscopy?</td>
<td>12</td>
<td>5</td>
<td>3</td>
<td>8</td>
<td>28</td>
</tr>
<tr>
<td>Yes</td>
<td></td>
<td>5</td>
<td>3</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>3</td>
<td>3</td>
<td>7</td>
<td>1</td>
<td>14</td>
</tr>
<tr>
<td>Would you purchase for personal Use?</td>
<td>11</td>
<td>4</td>
<td>7</td>
<td>8</td>
<td>30</td>
</tr>
<tr>
<td>Yes</td>
<td></td>
<td>4</td>
<td>7</td>
<td>8</td>
<td></td>
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<tr>
<td>No</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>1</td>
<td>12</td>
</tr>
<tr>
<td>Recommend EZ Trainer for residents?</td>
<td>12</td>
<td>7</td>
<td>9</td>
<td>7</td>
<td>35</td>
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<tr>
<td>Yes</td>
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<tr>
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<td>3</td>
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<td>2</td>
<td>7</td>
</tr>
</tbody>
</table>
ABSTRACTS – Session 1

ABSTRACT 118

TRANSRECTAL ULTRASOUND MEASUREMENT OF MEMBRANOUS URETHRAL LENGTH AS A PREDICTOR OF URINARY CONTINENCE AFTER LAPAROSCOPIC RADICAL PROSTATECTOMY

Kazumi Kamoi1, Inderbir S. Gill1, Georges-Pascal Haber1, Yi-Chia Lin1, Rodrigo Frota1, Tsuneharu Miki2, and Osamu Ukimura2

1Section of Laparoscopic and Robotic Surgery, Glickman Urological Institute, Cleveland Clinic Foundation, Cleveland, OH
2Department of Urology, Kyoto Prefectural University of Medicine, Kyoto, Japan

Introduction: We previously described the technical aspects of real-time transrectal ultrasound (TRUS) monitoring and guidance during laparoscopic radical prostatectomy (LRP). Herein, we determined whether membranous urethral length (MUL) on TRUS is predictive of urinary continence after LRP.

Methods: MUL was measured on preoperative and immediate postoperative TRUS in 133 consecutive patients with newly diagnosed prostate cancer who underwent LRP performed by a single surgeon. Patients filled out self-administrative questionnaires concerning about their continence at 1, 3, 6, 12, and 18 months after surgery. Postoperative continence was reported in 100 cases.

Results: Pre and postoperative length of membranous urethra measured by TRUS were 14.7 ± 1.7 and 13.0 ± 1.7 mm, respectively. A multivariate analysis showed that postoperative MUL was the only independent variable to predict continent status at 12 months after surgery. Eighty-three patients with a MUL greater than 11 mm had a 100% continence rate at 12 months after surgery. In contrast, only 35% of continence rate was achieved at 12 months after surgery in 17 patients with a preoperative MUL of 11 mm or less.

Continence recovery at 1, 3, 6, 12, and 18 months in 100 patients

<table>
<thead>
<tr>
<th>Time after surgery</th>
<th>Preoperative MUL&gt;13mm (N = 73)</th>
<th>Preoperative MUL≤13mm (N = 27)</th>
<th>Postoperative MUL&gt;11mm (N = 83)</th>
<th>Postoperative MUL≤11mm (N = 17)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 month</td>
<td>17 (23)</td>
<td>1 (4)</td>
<td>18 (22)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>3 months</td>
<td>41 (56)</td>
<td>4 (15)</td>
<td>45 (54)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>6 months</td>
<td>57 (78)</td>
<td>8 (30)</td>
<td>64 (77)</td>
<td>1 (6)</td>
</tr>
<tr>
<td>12 months</td>
<td>73 (100)</td>
<td>16 (60)</td>
<td>83 (100)</td>
<td>6 (35)</td>
</tr>
<tr>
<td>18 months</td>
<td>73 (100)</td>
<td>17 (64)</td>
<td>83 (100)</td>
<td>7 (41)</td>
</tr>
</tbody>
</table>

Conclusion: Measuring membranous urethral length using TRUS is feasible for patients with prostate cancer who undergo LRP. The longer length of membranous urethra is associated with early return of urinary continence after LRP.
VIDEO ROUNDBING SYSTEM (VRS): A PILOT STUDY IN PATIENT CARE

1Eric L. Kau, 2Dulce T. Baranda, 2Peachy B. Hain, 2Linda Burnes Bolton, 1Tony Chen, 1Gerhard J. Fuchs, and 1Christopher S. Ng

1Minimally Invasive Urology Institute and 2Department of Nursing, Cedars-Sinai Medical Center, Los Angeles, CA

Introduction: The integration of information technology (IT) with healthcare improvement is ever increasing. National initiatives, such as Transforming Care at the Bedside (TCAB), and hospital-based physician-nurse collaboration committees commonly utilize IT in tests-of-change to enhance patient care on Medical/Surgical units. We sought to determine the impact of “video rounding” on the postoperative care of urologic inpatients.

Patients and Methods: Laptop computers with built-in webcam and video conferencing software were used to establish a real-time video and audio connection between the patient and nurse at the bedside and the urologist at a remote location (office, home, or operating room). This video rounding system (VRS) was employed in addition to standard rounds at a later time during the same day. Ten patients were randomly selected and consented to participate with one of two surgeons. Post-VRS surveys were completed by patient, physician, and nurse using a 5-point Likert scale to evaluate ease of use/communication via VRS, comfort with VRS as an alternative means of communication, usage of VRS as a regular part of patient care, and video and audio quality.

Results: VRS was completed in all ten patients. Ten physician, ten patient and fourteen nursing surveys were completed. 90% of patients strongly agreed/agreed that they could easily communicate with their physician via VRS. All patients strongly agreed that VRS should be a regular part of patient care and that they would be comfortable using VRS if their physician was unable to be in direct contact with them. All physicians and nurses strongly agreed/agreed that VRS was easy to use, enhanced patient care, would be a comfortable alternative if direct physician contact was not possible, and that it should be a regular part of institutional care. For all participants, video and audio quality were rated excellent/very good by 91.1% and 70.6%, respectively.

Conclusion: Video Rounding System (VRS) has shown promising utility in enhancing patient care and improving communication between nurse, physician and patient. VRS is not intended to replace daily face-to-face physician rounding. Additional features of this system are currently being evaluated, including four-way simultaneous video rounding (surgeon in office, nephrologist at dialysis center, laparoscopic donor nephrectomy patient and transplant recipient in their rooms), as well as sending intraoperative photos and video clips during VRS for real-time patient/nurse education.
A NOVEL DEVICE FOR INTRAOPERATIVE IDENTIFICATION OF THE URETER: USING PROXIMITY SENSORS TO PREVENT INADVERTENT URETERIC INJURY

John C. Kefer¹, Inderbir S. Gill¹, Barry Kuban², Mihir Desai¹

¹Glickman Urological Institute, Cleveland Clinic
²Department of Biomedical Engineering, Lerner Research Institute, Cleveland Clinic

Introduction: Inadvertent intraoperative ureteric injury remains a significant concern during gynecologic, colorectal and vascular surgical procedures. Preoperative placement of standard passive ureteric stents can assist the non-urologic surgeon in tactile localization of the ureter, but the overall efficacy of standard ureteric stents for this application is limited. Here, we report a prototype intra-ureteric stent capable of emitting a moderate magnetic field, and utilizing a linear output Hall effect transducer (Honeywell Intl. Inc., Morristown, NJ) as an intraoperative magnetic proximity sensor, thereby precisely localizing intraureteral stent. One major design challenge was to integrate a moderate yet stable magnetic field within the full length of the stent without compromising the detection capabilities and sensitivity of the Hall transducer. This stent and proximity sensor system can be used more precisely localize the ureter intraoperatively, and may serve to decrease inadvertent ureteral injury.

Methods: A schematic drawing of the Hall effect transducer is shown below (Figure 1). Our stent design incorporates rare-earth neodymium-iron-boron (NdFeB) disc magnets (diameter 3.2mm x thickness 1.6mm) placed within the lumen of the stent at an offset 90° configuration, generating multiple North and South pole magnetic fields along the length of the stent. Dual DC power supply at 8V excitation powered the Hall transducer. Magnetic field proximity detection was quantified using a 500 MHz oscilloscope set at 50 MHz. The magnetic stent was fixed in place ex vivo, and the Hall sensor was brought within increasing proximity to the stent from 7 cm to 2 cm distance at 1 cm intervals, and then at 0.1 cm intervals from 2.0 to 1.0 cm proximity from stent (Table 1). The sensor was brought within 1 cm proximity to the stent from all exposed sides of the stent and the changes in the Hall sensor current and standard deviation were recorded.

Results: The Hall transducer reliably detected increases in the magnetic field strength of the ureteric stent from 7 cm distance to 1 cm distance from the stent. This increase in detected field strength with increasing proximity occurred when approaching the stent from all angles of attack, including passing the sensor perpendicularly and parallel to the stent, making this device design suitable for localizing the position of the ureter intraoperatively.

Conclusion: We report a novel stent design allowing precise localization of the ureter during intra-abdominal and pelvic surgeries utilizing a proximity sensor to detect magnetic fields from within the ureteric stent. This stent may serve to decrease the rate of inadvertent intraoperative ureteral injury, and allows the non-urologic surgeon the ability to actively identify the ureter during surgical procedures.
Magnetic field changes are reliably detected with increasing proximity to stent.
USEFULNESS OF PREOPERATIVE MULTIDETECTOR-ROW COMPUTED TOMOGRAPHY WITH THREE-DIMENSIONAL PELVIC ANGIOGRAPHY IN PATIENTS WHO UNDERGO PELVIC LYMPHADENECTOMY IN ROBOT-ASSISTED RADICAL PROSTATECTOMY: PRELIMINARY ANALYSIS OF OUTCOMES

Sung Yul Park, Young Taik Oh, Woong Kyu Han, Kang Su Cho, Seung Wook Lee, Byung Hyun Soh, Joo Wan Seo, Hyung Joon Kim, Koon Ho Rha, Seung Choul Yang

Departments of Urology and Radiology, College of Medicine
Urological Science Institute and Brain Korea 21 Project for Medical Science, Yonsei University, Seoul, Korea

Introduction: Recently, the use of robot in radical prostatectomy is being more widespread and there have been reported life-threatening accidents during the pelvic lymph node dissection due to the lack of tactile feedback of the robotic instrumentation. The purpose of this study was to assess the value of preoperative multidetector-row computed tomography with three-dimensional pelvic angiography before pelvic lymphadenectomy during robot-assisted radical prostatectomy by single surgeon.

Methods: Five patients who had taken preoperative multidetector-row computed tomography with three-dimensional pelvic angiography, followed by pelvic lymphadenectomy in Robot-assisted radical prostatectomy, were compared to 5 patients in the same period without three-dimensional reconstruction who were matched for BMI, prostate volume and pathological stage. We analyzed operative time, intraoperative complications, procedure difficulty as scored by the surgeon, and lymph node numbers during lymphadenectomy.

Results: The number of resected lymph nodes was greater (9.5 vs. 5.6) and the procedure was easier in the three-dimensional reconstruction group. None of 5 patients were scored as difficult as compared to 3 out of 5 patients in the difference between three-dimensional reconstruction group. There were no differences in operative time of lymphadenectomy and intraoperative complication. The images could successfully visualize pelvic vascular structure and lymph nodes relationship, which greatly aided the navigating through potentially dangerous areas of dissection with the da Vinci robot. (Video portion will be shown at the time of presentation.)

Conclusion: Preoperative multidetector-row computed tomography with three-dimensional pelvic angiography is useful in visualization of pelvic vascular structure and lymph node relationships, especially obturator nerve, during robot-assisted radical prostatectomy and so the surgeon can do an accurate pelvic lymphadenectomy.

* This work was supported by the Brain Korea 21 Project for Medical Science, Yonsei University and 2007 Korean Food and Drug Administration Research Fund.
ABSTRACTS – Session 1

ABSTRACT 122

USE OF A PHASE-TRANSITION POLYMER TO DECREASE RETROPULSION AND INCREASE EFFICIENCY OF LITHOTRIPSY: AN IN VITRO STUDY

Christopher C. Kyle, Robert I. Carey, Vishal Bhalani, and Raymond Leveillee

University of Miami Miller School of Medicine, Miami, Florida, USA

Introduction: Retropulsion of stone during intracorporeal lithotripsy reduces efficiency. Mobile stones that migrate from their site in the ureter or kidney require increased operating room time and may result in trauma to the urothelium secondary to prolonged endoscopy. We propose the novel use of a rapid phase transition polymer (PTP) from Pluromed (Woburn, MA) to immobilize and better target stones in the ureter. The polymer solution is a pumpable, free-flowing liquid at cool temperatures. At body temperature, this material warms to a transparent gelatinous phase behind the calculi and immobilizes them for lithotripsy.

Methods and Materials: An underwater setup with saline at 37°C was used. A cone-shaped Ultracal-30 Gypsum (Chicago, IL) stone phantom (mean 0.41 gm) was placed at one end of a horizontally oriented calibrated silicone tube with diameter 0.6cm. Holmium laser lithotripsy with a 400µm bare fiber was performed sequentially on 20 artificial stones with settings of 0.8kJ and 5 Hz for a total of 120 seconds. For 10 stones, 1ml of 20% PTP was instilled behind the stone. Retropulsion was defined as distance traveled from origin, and fragmentation efficiency defined as percent weight loss.

Results: Stone size, shape, location, and composition were identical and controlled variables. Mean net retropulsion was 8.6cm versus 1.0cm for the control and PTP groups, respectively (p<0.01). Mean fragmentation was 24% and 42%, respectively (p<0.01).

Conclusions: Retropulsion of stones wastes time and energy during lithotripsy. Stabilization of a stone with PTP decreased retropulsion and increased fragmentation efficiency in this in vitro model.

Disclosure. This project was supported by a grant from Pluromed, Inc. (Woburn, MA)
ABSTRACT 123

HISTOTRIPSY THRESHOLD OF VARIOUS RENAL TISSUES IN PORCINE KIDNEY

University of Michigan.

Background: Minimally invasive treatment for small renal masses continues to evolve. Previously, we have demonstrated the success of transcutaneous nonthermal mechanical tissue ablation (histotripsy) of in vivo rabbit kidney tissue. It is our purpose to explore the bio-effect of histotripsy on the various tissue types in an in vitro porcine kidney model. We hypothesize that the different renal tissue types (cortex, medulla, and collecting system) will exhibit different thresholds for damage when treated with ultrasound parameters within the range for histotripsy.

Materials and Methods: We used an 18 element focused annular array ultrasound system to perform a series of ablations in 5 in vitro porcine kidneys. Seven control lesions were created in purely cortical tissue to demonstrate the expected appearance of a lesion created by a specific scanning pattern. This same scanning pattern was then used to create 17 lesions bridging cortex, medulla, and collecting system. The treated areas were observed with in-line diagnostic ultrasound. The kidneys were sectioned and gross pathology was examined for tissue ablation and presence of histotripsy “paste”. In one treated kidney, methylene blue dye was infused into the collecting system post-treatment to check for preservation of collecting system integrity in 5 lesions.

Results: Histotripsy of porcine renal cortical tissue in the 7 control lesions liquefied the cortical tissue and resulted in a liquid paste-filled cavity on gross sectioning. Histotripsy targeting renal collecting system, medulla, and renal cortex resulted in ablative lesions in the area of cortex, intermediate damage in the medulla, and no significant damage to the collecting system on ultrasound imaging, gross pathology, and histopathology.

Conclusions: There is a differential treatment effect of mechanical tissue ablation by ultrasound when comparing renal cortical tissue, medullary tissue, and collecting system. There is no significant architectural disruption in the renal collecting system when treatment is performed in the range of histotripsy (nonthermal ablative) parameters. This differential effect is a notable finding which may prove useful in planning ablative treatments for renal tissue in the future.
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COMPARISON OF THE HISTOLOGIC ACCURACY OF NEEDLE BIOPSY BEFORE AND AFTER RENAL CRYOABLATION: LABORATORY AND INITIAL CLINICAL EXPERIENCE

Erica H Lambert*, Gregory W Hruby, Jorge O Abundez, Andrew Edelstein, Jason Karpf, Evren Durak, Jaime Landman, Courtney K Phillips, Daniel S Lehman, New York, NY

Introduction and Objective: With the rapid proliferation of ablative technologies for renal cortical neoplasms, needle biopsy is often the only histopathology data available. In order to minimize the risks associated with needle biopsy, including tumor seeding and hemorrhage, we examined the feasibility of needle biopsy after renal cryoablation.

Methods: In normotensive live domestic pigs, 4 cryolesions were created bilaterally on normal renal tissue with an 8-minute double-freeze cycle using a single 17-gauge cryoprobe. Biopsies were obtained with a 16G biopsy needle before and after cryoablation under direct vision. Each biopsy specimen was evaluated for the number of glomeruli and arterioles. A two-sample t-test was used to analyze the data. Subsequently, 10 patients with small renal masses underwent laparoscopic cryoablation using a standard double freeze-thaw cycle. An 18G biopsy needle was utilized to sample the renal mass with a single core taken before and after cryoablation. A blinded pathologist evaluated the specimens for the histologic accuracy of the two tumor tissue sampling techniques. Chi-square statistic was used to determine an association between the diagnostic quality of the core specimen and the type of biopsy.

Results: 200 biopsies were obtained from porcine renal tissue. The mean number of glomeruli for the pre, and post-cryoablation sample was 9.6, and 7.8, respectively (p=0.04). The mean number of arterioles for the pre and post-cryoablation group was 2.3 and 1.9, respectively, (p=0.04). During clinical application, 6/10 pre-cryoablation, and 7/10 post-cryoablation biopsies were diagnostic (p=0.639). Histopathology was established in all 10 cases: conventional RCC (7/10), papillary RCC (1/10), AML (1/10), and oncocytoma (1/10). There was no significant bleeding from any needle biopsy.

Conclusions: The porcine model established the feasibility of histologic diagnosis after cryoablation albeit a significant deterioration in the biopsy quality. Our initial clinical experience demonstrates that post-cryoablation biopsy has similar diagnostic yield to pre-cryoablation biopsy. The advantage of post-cryoablation biopsy is a theoretical decrease in the risk of tumor seeding and hemorrhage. Further clinical correlation is in progress to validate this novel approach to histopathologic diagnosis of renal tumors treated with cryoablation.
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EVALUATION OF LAPAROSCOPIC VASCULAR CLAMPS USING A LOAD-CELL DEVICE: ARE ALL CLAMPS THE SAME?

Hak J. Lee*, Geoffrey N. Box, Leslie A. Deane, Reza AliPanah, Mike B. Taylor, Erick R. Elchico, Corollos S. Abdelsheheed, Jose B. Abraham, Elspeth M. McDougall and Ralph V. Clayman

Department of Urology, University of California, Irvine, CA

Introduction: Laparoscopic partial nephrectomies are performed more frequently as urologists become more comfortable with the technique. Based on our experience, the occlusive capabilities of vascular clamps appear to be quite variable. We sought to determine whether this was due to the clamps themselves or to the anatomy unique to each patient.

Methods: The force of laparoscopic vascular clamps from Aesculap Inc. (Germany), Klein Surgical Inc. (San Antonio, TX) and Karl Storz Inc. (Culver City, CA) were tested by clamping a 2.2 mm button-style compression load cell (Interface, Scottsdale, AZ) and measured in pound-force (lbf). The variables tested included: internally vs. externally applied clamps, position of application on the clamp (e.g. tip, middle, end (full length of instrument)), old vs. new bulldogs, and for the non-bulldog clamps, the number of notches in their locking mechanism used to secure the jaws. Finally, a harvested porcine artery (was used to determine the relationship between force and leak pressure (mmHg) of Klein (two row of teeth) vs. Aesculap (one row of teeth) bulldogs using a Cole-Parmer pressure gauge (Vernon Hill, IL).

Results: The chart shows the mean force (lbf) for each instrument in each position, categorized by type of clamp and manufacturer. All of the externally applied vascular clamps provided higher pressures than the internally applied bulldog clamps. Also, there was a direct correlation between the increase in force and notches in the externally applied clamps. In addition, for all instruments, application at the end of the clamp provided the greatest force compared to the other positions. The three year-old Klein and Aesculap clamps showed approximately 46% and 20% decrease in force respectively at all positions compared to new bulldogs. Finally, the table shows the force and leak pressure relationship, categorized by manufacturer and position on the clamp.

Conclusion: The force generated by the clamps tested was variable depending upon the type and positioning of the clamp. In addition, with years of use, the clamping force of bulldog clamps may diminish below arterial pressure. Finally, the ex vivo testing revealed that at a given pressure the number of rows of teeth may be inversely correlated to the leak pressure.
ABSTRACT 126

“ROBOCONSULTANT”: TELEMENTORING AND REMOTE PRESENCE IN THE OPERATING ROOM USING A NOVEL MOBILE ROBOTIC INTERFACE

Li-Ming Su*, Mohamad E. Allaf, Rahul Agarwal, and Adam W. Levinson

James Buchanan Brady Urological Institute, Johns Hopkins Medical Institutions, Baltimore, MD

Introduction/Objective: Remote presence is the ability of an individual to project himself from one location to another to see, hear, roam, talk and interact just as if that individual were actually there. The objective of this study was to evaluate the efficacy and functionality of a novel mobile robotic telementoring system controlled by a portable laptop control station linked via broadband internet connection.

Methods: “RoboConsultant” (RP-7, InTouch Health®, Sunnyvale, CA, see Figure 1) was employed for the purpose of intraoperative telementoring and consultation during five different laparoscopic and endoscopic urologic procedures with both the operating room team and surgical consultant evaluating the efficacy of the robot after each procedure. Robot functionality including navigation, zoom capability, examination of external and internal endoscopic camera views, and telestration were evaluated. The robot was controlled by a senior surgeon from various locations ranging from an adjacent operating room to an affiliated hospital 5 miles away.

Results: The “RoboConsultant” performed without connection failure or interruption in each case, allowing the consulting surgeon to immerse himself and navigate within the operating room environment and provide effective communication, mentoring, telestration and consultation.

Conclusions: “RoboConsultant” provided clear, real-time and effective telementoring and telestration and allowed the operator to experience remote presence in the operating room environment as a surgical consultant. The portable laptop control station and wireless connectivity allowed the consultant to be mobile and interact with the operating room team from virtually any location. The advantages of this device over conventional teleconferencing is its ability to be mobile and roam within the operating room, relatively small size and footprint, ability to evaluate multiple operative views, and its zoom, image capture and telestration features. The remote presence provided by the “RoboConsultant” may prove in the future to provide useful and effective intraoperative consultation by expert surgeons located in remote sites.
VIRTUAL REALITY PRESENTATION OF NORMAL FEMALE PELVIC FLOOR

Xiaolong Li¹, Joseph C. Veniero², Chi Chiung Grace Chen², Matthew Barber², Margot S. Damaser¹,²,³
¹Cleveland State University, Cleveland, OH ²Cleveland Clinic, Cleveland, OH
³Wade Park VA Medical Center, Cleveland, OH

Introduction: Stress urinary incontinence and pelvic organ prolapse affect millions of American women. The cause still remains elusive and part of the reason is the limited knowledge of the anatomy of the female pelvic floor due to its complexity. In order to better understand the anatomy, we are building a virtual reality (VR) model of normal female pelvic floor based on high resolution magnetic resonance (MR) images. We present our initial results with different segmentation techniques as well as with building the model for virtual reality.

Methods: High resolution T2 weighted MR images were used to build the models of bladder, vagina, rectum, urethra, uterus and pelvic bones. Gadolinium enhanced T1 weighted MR images were used to build the model of vessels. T2 weighted images together with out-of-phase T1 weighted images were used to build the models of obturator and levator ani muscles. The images were preprocessed with a nonlinear anisotropic filter and a local contrast enhancement filter. A contour-based semi-automatic segmentation method was used to segment the bladder as a test organ, since it has high contrast in T2 weighted images. For other organs such as vagina, urethra, uterus, rectum and muscles, we used manual segmentation. The 3D region grow method was applied for automated segmentation of vessels. A constrained smooth function was applied to smooth the surface of model without changing the volume and shape of the organs and muscles. The segmented organs, muscles and tissues were built into a VR model using Amira 4.11 and were verified by experts from radiology and urogynecology.

Results: Three samples have been segmented and a VR model has been created (Fig. 1). The surface of the model has been simplified for quick loading and representation. The results were verified by experts from radiology and urogynecology and an adequate result was achieved. The segmented organs can be viewed simultaneously with reviewing the original MR scans. The color and transparency of each component can be adjusted independently.

Conclusion: High resolution MR provides detailed information of the anatomy of female pelvic floor. This method of viewing the pelvic floor organs and tissues may have the potential for application in research, education, and clinical practice. Acceleration of the segmentation process by automated or semi-automated segmentation methods will facilitate use of this technology in all 3 areas.

Figure 1. Pelvic Floor 3-D model showing A. bones, muscles, & tissues, and B. Vessels
AN EX VIVO MODEL FOR STRAIN-INDUCED PATHOLOGIES OF THE BLADDER

Rebecca A. Long¹, Aron Parekh¹, Michael B. Chancellor², and Michael S. Sacks¹

¹Department of Bioengineering, University of Pittsburgh, Pittsburgh, PA
²Department of Urology, University of Pittsburgh, Pittsburgh, PA

Introduction: An understanding of the particular cues that trigger remodeling in diseased states of the bladder is necessary in order to properly treat patients with spinal cord injury (SCI) and other disorders affecting the bladder wall. Using ex vivo organ culture in a bioreactor system, we studied bladder tissue with mechanical stimuli mimicking pathological strain levels without exposing animals to SCI.

Methods: Bladders were extracted from female Sprague-Dawley rats (200-300 g) following euthanasia. Strips were excised from the bladders and attached on the longitudinal ends to be stretched in the longitudinal direction up to 7 days under sterile conditions. The remodeling of the bladder detrusor in response to static culture, cyclic stretch, “normal micturition”, and mimicked “SCI micturition” cycles was assessed with a collagen assay kit (Sircol) and total elastin was measured by an elastin assay kit (Fastin) according to the manufacturer’s instructions. Histology was also performed to assess changes in tissue morphology.

Results: Cyclic stretch at 0.5 Hz significantly (p<0.05) up-regulates elastin production compared to fresh tissue and all other organ culture conditions (Figure 1). Additionally, “SCI micturition” appears to have increased soluble collagen compared to cyclic stretch or “normal micturition” conditions (Figure 1); however, fresh bladder tissue and static culture for 7 days have larger amounts of soluble collagen compared to all stretched groups (Figure 1).

Conclusion: Ex vivo organ culture of the bladder provides a means to separate the effects of innervation and separates the tension associated with bladder filling from contractile forces. It also maintains the cell-matrix interaction of the intact organ and allows isolate on of the intact organ from systemic humoral and neurological influences. This is the first report of developing toward ex vivo organ culture model of neurogenic bladder dysfunction.

Figure 1 – Soluble collagen and total elastin concentration of bladders. Data are presented as mean +/- s.e.m. N = 5 or 6 per group. * p<0.05

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ABSTRACT 129

AID TO PERCUTANEOUS RENAL ACCESS BY VIRTUAL PROJECTION OF THE ULTRASOUND PUNCTURE TRACT ONTO FLUOROSCOPIC IMAGES

P. MOZER 1,2, A. LEROY 2,3, P. CONORT 1, M. BAUMANN 2,3, G. CHEVREAU 1,2, J. TROCCAZ 2, E. CHARTIER-KASTLER 1, F. RICHARD 1.

1 Department of Urology, Pitié -Salpêtrière Hospital, Pierre et Marie Curie University (Paris VI) Paris, France.
2 TIMC Laboratory, IN3S, Faculté de Médecine, Domaine de la Merci, 38706 La Tronche cedex, France.
3 KOELIS© - www.koelis.com

Introduction Percutaneous renal access in the context of percutaneous nephrolithotomy (PCNL) is a difficult technique, requiring rapid and precise access to a particular calyx. We present a computerized system designed to improve percutaneous renal access by virtually projecting the ultrasound nephrostomy tract onto fluoroscopic images.

Material and Method The software system, developed by Koelis (Koelis, 5 av Grand Sablon F-38700 La Tronche), runs on a Surgetics® navigation platform using stereo camera. Thanks to the fluoroscopic calibration cage, a rigid-body reference attached to the ultrasound probe can be tracked in real time with respect to the patient reference attached to the operating table (Fig. 1 and 2). The set-up of the system takes 5 minutes at most.

- The first step consists in acquiring fluoroscopic images in various orientations, which are particularly useful to visualize all of the calices and to determine the axis of caliceal stalks. As the kidney moves with breathing, the anaesthetist is asked to stop ventilation for a 10-second period at the end of expiration to take images, so that the acquired images are coherent. The fluoroscope is then removed from the operative field to leave more space for the operator.

- From this point on, the computer system, that has integrated the spatial position of the fluoroscopic images, is able to display on them the nephrostomy tract selected on the ultrasound transducer without any human intervention. The ultrasound transducer, fitted with its puncture guide, is the only device in motion. The operator visualizes, in real time, both the puncture tract on the ultrasound image and its virtual representation on all fluoroscopic views (Fig. 3). The operator is therefore able to determine the optimal puncture position and to visualize the progression of the needle on the ultrasound monitor.

Results After laboratory tests on a phantom and approval by our institution’s Ethics Committee, we validated this technique in the operating room during 8 PCNL procedures.

- For 6 patients, a single puncture was sufficient to reach the target in an optimal way. Accuracy was checked visually by the correct superimposition of the virtual puncture tract on a fluoroscopic image of the inserted needle (Fig 4).

- For 2 other patients, 3 puncture trials were necessary. The distance between the computed needle tract and the visualized tract by fluoroscopic images were on average of 1 cm. This error was only due to the deformation of the needle during the puncture.

No intraoperative complication was observed for all cases.
Conclusion Those two imaging systems provide a real synergy, while leaving the surgeon completely free to perform the operative procedure. Our navigation system is reliable and the absence of image processing procedures makes it robust. We currently work on a mechanical system able to help the surgeon to perform the puncture without deformation of the needle. We have initiated a prospective study to validate this technique, both as a surgical tool for PCNL specialists and as a teaching tool.

Figure 1: Operative Setup

Figure 2: Ultrasound Probe
and Figure 3: Virtual Projection. Right: Fluoroscopic Images; Left: Ultrasonic image.

Figure 4: Superposition Virtual Puncture Tract (Yellow) and Needle
ACCURACY EVALUATION OF PROSTATE BIOPSIES UNDER ENDORECTAL 2D ULTRASOUND

P.MOZER 1,2, M. BAUMANN 2,3, G. CHEVREAU 1,2, P. CONORT 1, E. CHARTIER-KASTLER 1, F. RICHARD 1, J. TROCCAZ 2

1 Department of Urology, Pitié-Salpêtrière Hospital, Pierre et Marie Curie University (Paris VI) Paris, France.
2 TIMC Laboratory, IN3S, Faculté de Médecine, Domaine de la Merci, 38706 La Tronche Cedex, France.
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Introduction: In clinical practice, prostate biopsies are performed under endorectal 2D ultrasound control and the clinician samples the prostate gland according to a predefined pattern. It seems, however, difficult to accurately reach 3D targets with 2D ultrasound. We evaluated the accuracy of a single operator performing a pattern of 12 biopsies under 2D ultrasound by registering 3D ultrasound control images acquired after each biopsy.

Material and Method: Using a Voluson-i and a RIC 5-9 probe from General Electric, we performed 2D transrectal biopsies on 15 patients according to the pattern illustrated Figure 1 with a Tru-Cut (18-gauge needle, cutting length of 23 mm). The protocol used was a 12-biopsy scheme.

Protocol of image acquisition and registration:
- Each biopsy was done under local anesthesia with a standard 2D guidance. 3D acquisition was made as the needle was inside the prostate. For each acquisition, the operator took care, as far as possible, not to deform the prostate with the ultrasound probe.
- For each patient, prostate image alignment was carried out automatically with an image-based volume to volume rigid registration algorithm. Image-based registration is principally an optimization problem based on a similarity measure, with the objective to retrieve the transformation between two images. Registration accuracy was verified visually. This procedure makes it possible to replace every biopsy trajectory in a single ultrasound reference volume.

Measure:
- The ultrasound volume was reformatted in the coronal plane and a bounding box was created around each target according to the preoperative 2D pattern (hence 12 identical square coronal sectors - Fig 2).
- For each target, we checked that the corresponding biopsy was inside the bounding box, and in the positive case we measured the inner length of the biopsy.

Results: 172 biopsies were performed; 8 volumes (5%) were misregistered due to bad image quality. Table I. shows the ratio of biopsies reaching their bounding box and their inner length. On average, the operator reached the target in 63% of all cases. The ratio decreases as the planning approaches the boundaries of the prostate (from 100% in MP to 79% in ML). At lateral base and apex sides the lowest ratios may be explained not only by the difficulty to reach the targets, but also by the low prostate presence in those sectors. The relatively low inner length ratios tend to prove the inadequacy between a theoretical regular and parallel planning pattern and the actual constrained transrectal access.

Conclusion: This study shows that it is difficult to accurately reach targets in the prostate using 2D ultrasound. Irregular prostate sampling, and in particular local undersampling, reduces the sensitivity of the prostate biopsy procedure. Advanced prostate localization methods may allow more complex but more realistic plans that would help increasing the success rate of biopsies and mapping's accuracy.
<table>
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<th>Number of biopsies inside the target</th>
<th>% of biopsies inside the target</th>
<th>% of biopsy length inside the target</th>
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<td>BP</td>
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<td>63 %</td>
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Table I. Biopsy accuracy results. B=Base, M=Mid-Gland, A=Apex, L=Lateral, P=Parasagittal (Right and Left).

Figure 1. Biopsy Pattern (12 Biopsies)

Figure 3 : Bounding Box & target
EVALUATION OF 24 HOLMIUM:YAG LASER OPTICAL FIBERS FOR FLEXIBLE URETEROSCOPY

Adam Mues¹, Joel M.H. Teichman², Randolph D. Glickman³, Bodo E. Knudsen¹

¹Ohio State University Medical Center, Columbus, USA
²University of British Columbia, Vancouver, Canada
³University of Texas Health Science Center at San Antonio, San Antonio, USA

Introduction: Prior studies show holmium:YAG laser fiber performance varies among manufacturers. Manufacturers have attempted to correct fiber deficiencies, yet failures continue. This study determined the performance of 24 fibers commercially available in 2006.

Method: Twenty-four commercially available fibers (150 µm – 365 µm) were evaluated from IQinc, Boston Scientific, Laser Peripherals, Trimatede, Dornier, Lumenis, and Convergent. Fiber flexibility was evaluated by maximally deflecting a Stryker U-500 ureteroscope with the fiber in the working channel. The diameter of each fiber was measured by digital micrometer. Fiber durability was assessed by bending the fibers to 180° at a radius of 1.25 cm. The laser was operated at 1.5 J, 10 Hz, for 1 minute or until failure. The bend radius was reduced in 0.25 cm increments and the testing repeated, until a bend radius of 0.5 cm was reached or until failure. Three trials for each fiber were run. A Lumenis VersaPulse 100W holmium:YAG laser was used. All testing was done with the fiber submerged in water.

Result: The IQinc SureFlex LLF-150 is the most flexible fiber the Convergent OptiLITE SMH1040F the least flexible. The BSci Accuflex 150 and Accuflex 365 have the smallest and largest true diameters respectively. The IQinc SureFlex LLF-150, IQinc LLF-273, Dornier LG Super 270, and Convergent OptiLITE SMH1020F did not fail at the minimum bend radius. The BSci AccuFlex200 failed at the largest bend radius and coupled poorly with the laser.

Conclusion: Fiber safety and performance continues to vary widely amongst different fibers.
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**REAL-TIME POINT-TO-POINT WIRELESS INTRANET CONNECTION: FIRST IMPLICATION FOR SURGICAL DEMONSTRATION, DECISION-MAKING AND TELEMENTORING IN LAPAROSCOPY IN IRAN**


Birjand University of Medical Sciences.
Birjand- Iran
Add: P.O. Box: 493
E-mail: nadjafi@hbi.ir

**Introduction:** To determine whether an inexpensive setup of point-to-point wireless Intranet connection can provide adequate video and audio teleconferencing and image quality to support remote real-time surgical demonstration and telementoring. To our knowledge, there is no similar report from Iran.

**Methods:** A surgeon performing a novel laparoscopic extraperitoneal trigonoplasty for correction of bilateral vesico-ureteral reflux (right grade III and left grade I) in a 10-year-old boy in Emam Reza hospital, Birjand- Iran, shared real-time laparoscopic images with his mentor and innovator of this new technique at the Birjand University of medical sciences, 5 kilometer away from each other through a point-to-point wireless Intranet connection, using the university’s local area network (LAN) and Windows media encoder and Windows media player software programs. To evaluate the quality of transmitted real-time images, the mentor’s opinion was sought. In addition, paired local and remote images were “captured” from the video feed and evaluated to compare the effect of transmission on image quality.

**Results:** The connection permitted adequate video and audio teleconferencing to support real-time consultation. The quality of the transmitted images was so high that the mentor was able to identify the bare ureteral wall and Waldeyer's sheath during the laparoscopic trigonoplasty. The qualities of the paired local and remote images were similar.

**Conclusions:** A point-to-point wireless Intranet-based telemedicine is relatively inexpensive and effective. Use of this setup will allow sharing of surgical procedures.
ABSTRACT 133

URETEROSCOPY FOR UROLITHIASIS: AN AUDIT OF USE OF SEMIRIGID AND FLEXIBLE URETEROSCOPES

Prabhakar Pandey, Lisa D Monahan and Cheryl D Marsh

Urology Clinic of Cumberland Cumberland, MD 21502

Introduction: Improved technical skills and advancements in instrumentation have made ureteroscopy an effective management option for urolithiasis. However, there is limited information on the clinical role of semi rigid and flexible ureteroscopes. This study aims to evaluate the role of commonly available ureteroscopes in clinical practice.

Material & Methods: Records of ureteroscopy for urolithiasis was reviewed to gather information on (a) patient demographics, (b) use of a preoperative ureteral stent, (c) use of various ureteroscopes [manufacturer – Gyrus ACMI; ureteroscope models – MR6L (semi rigid), DUR-8 (flexible ureteroscope without active secondary deflection) and DUR-8 Elite (with active secondary deflection)] and their sequence of use, (d) manner of entry and negotiation through the ureter during the first passage of the ureteroscope, (e) intra renal visualization and (f) associated ureteroscope related injuries and their outcome on subsequent imaging studies.

Results: 178 patients (males 80, females 98; mean age 53.3 years), during June 1, 2003 to February 1, 2007, underwent ureteroscopy for urolithiasis. 57(32%) were stented preoperatively. 324 ureteroscopes [MR6L – 138(43%), DUR-8 – 172(53%) and DUR-8 Elite – 13(4%)] in variable number of passes were used to complete the procedure. Semi rigid ureteroscope utilized in 132 of 178 instances of first passage was introduced in to the ureteral orifice utilizing (a) pulsed irrigation – 97(54.5%), (b) over second guide wire – 37(20.8%) and (c) following balloon dilatation of ureteral orifice – 4(3.1%). Manner of entry demonstrated significant difference in relation to (i) gender (Pearson Chi-square, p=0.016) and (ii) preoperative stent (Pearson Chi-square, p<0.0001). Ureteral negotiation of MR6L demonstrated significant association with gender (Pearson Chi-square, p=0.025). Ureteral inspection with MR6L was limited in 5(3.8%) due to prominent pelvic promontory 4(male 2; female 2) and pelvic mass 1. Flexible ureteroscope was utilized in 185 [DUR-8 – 172(92.97%); DUR-8 Elite – 13(7.03%)] passes. DUR-8 Elite was required due to (a) unavailability of DUR-8 – 6(46.15%) and (b) difficult calyceal access – 7(53.8%). Ureteroscope related injuries were noted in 5 (2.8%) – perforation with complete resolution – 3, minor mucosal flap injury with complete resolution -2.

Conclusion: Ureteral visualization may be successfully carried out in majority of cases with semi rigid ureteroscope. Gender difference was significantly associated with ureteral orifice entry and negotiation. Manner of ureteral orifice entry was dependent on previous ureteral stenting as well. Flexible ureteroscope with active secondary deflection was required in small minority with difficult calyceal visualization. Ureteroscope related injury was found to be infrequent and demonstrated resolution.
ABSTRACTS – Session 1

ABSTRACT 134

ROBOTIC da Vinci PROSTATECTOMY: THE GREEK EXPERIENCE

Nick Pardalidis, Nick Andriopoulos
Athens Medical Center Athens, Greece

Purpose: Radical prostatectomy is the treatment of choice for the management of organ-confined prostate cancer. Minimal invasive treatments as an alternative, have been refined recently by the addition of the da Vinci robotic technology, which has revolutionized over the last 5 years and is still gaining popularity. We present our initial experience performing radical prostatectomy using the da Vinci (Intuitive Surgical) tele-robotic system.

Patients and methods: Since the beginning of October, ten (10) patients underwent robotic da Vinci radical prostatectomy. All patients had pre-operative PSA values<10 and Gleason score<7. Their mean age was 62 years (52-69). Trans-peritoneal approach with five (5) port placements was performed in all patients. Step 1. Posterior dissection of the seminal vesicles and opening of the Denonvillier fascia, towards the prostatic apex. Step 2. Anterior dissection was performed by opening the endopelvic fascia and the lateral borders of the prostate. Step 3. Dissection of the bladder neck and the prostatic pedicles. Step 4. Dissection and preservation of the neurovascular bundles from the base of the prostate to the apex using an athermal interfascial technique. Step 5. Dissection of urethra with cold scissors and freeing the prostate from surrounding attachments. Step 6. Ligation of the dorsal venous complex with 2.0 Biosyn suture and continue creating the urethrovesical anastomosis using a running 2.0 Biosyn suture.

Results: There were no intra-operative complications. The mean blood loss was 150 ml. The mean hospital stay was 2 days. The mean catheter indwelling time was 7 days. The patients reported minimal post-operative pain and resumed regular diet on the first day. The 3 robotic instruments used were Maryland bipolar forceps, round-tip scissors, and a needle-holder. Although the initial setup (patient and robot positioning) and port placement consumed 30-45 minutes in the first cases, it is now refined to 15 minutes. The procedural time was 5 hours for the first couple of cases and approximately 3 hours for the latest one. Early recovery of continence (7 days after catheter removal) was observed, probably due to better visualization and exposure of the anatomy of the male pelvis, as well as from precise dissection achieved by the robotic arms.

Conclusions: Robotically-assisted laparoscopic prostatectomy is an excellent instrument for the urologic armamentarium. The use of robotics may result in even better surgical outcomes than conventional laparoscopy. The method is feasible and effective for the treatment of localized prostate cancer. Our initial experience is very promising. We are assuming that with increasing experience we’ll be able to further reduce operative time, resulting in earlier patient recovery and discharge from the hospital.
HEMOSTATIC HYDRODISSECTION OF THE NEUROVASCULAR BUNDLES (HYNEB) DURING LAPAROSCOPIC RADICAL PROSTATECTOMY: EARLY POTENCY AND CONTINENCE OUTCOMES

Sijo J. Parekattil, Nicholas Franco, Jonathan K. Jay

University of Florida, Gainesville and Cleveland Clinic Naples, FL

Introduction: Preservation of continence and potency after Laparoscopic Radical Prostatectomy (LRP) are two key outcome measures that patients consider when comparing different treatment options for localized prostate cancer. This study presents the early potency and continence outcomes after Hemostatic Hydrodissection of the Neurovascular Bundles (HYNEB) during LRP.

Methods: Prospective analysis of 30 consecutive LRP patients from September 2005 to October 2006 with follow up ranging from 1 to 14 months. Standardized, validated quality of life measurement tools including the Sexual Health Inventory for Men (SHIM) were utilized pre-operatively and postoperatively at three month intervals to assess potency and incontinence outcomes after the HYNEB procedure.

Results: 93% of the patients were continent (defined as using no pads at all or only 1 pad for safety daily) at the time of this analysis. 37% (11 patients) achieved continence by 1 week post-op, 63% had achieved continence by 1 month and 90% by 3 months. Of the patients with a preoperative SHIM of greater than or equal to 17 (8 patients), 63% (5 patients) had return to a SHIM score greater than or equal to 17 (without the use of oral or injectable erectile dysfunction therapy) by 6 months. 2 patients were able to have satisfactory intercourse without any oral or injectable therapy by 1 month post-op.

Conclusion: Hemostatic Hydrodissection of the Neurovascular Bundles (HYNEB) during LRP may promote the early return of continence and erectile function. The preliminary findings appear promising.
VIDEO-ASSISTED MINILAPAROTOMY (VAMS)—NEPHRON SPARING
SURGERY: TECHNIQUE, RESULTS AND OUTCOME

Woong Kyu Han, Joo Wan Seo, Hyung Joon Kim, Kang Su Cho, Seung Wook Lee, Byung Hyun Soh,
Sung Yul Park, Young Taik Oh, Koon Ho Rha, Seung Choul Yang
Department of Urology, College of Medicine
Urological Science Institute and Brain Korea 21 Project for Medical Science
Yonsei University, Seoul, Korea

Introduction and Objective: Video-assisted Minilaparotomy Surgery (VAMS) has been developed as a new
gasless minimally invasive surgical procedure that is a hybrid of laparoscopic and open surgery since 1993. We
reported technical feasibility and outcomes of partial nephrectomy using VAMS technique.
Methods: A 6 to 7cm. sized transverse skin incision was made anteriorly from the costal margin corresponding to
the level of the 10th rib. We could obtain sufficient operative space around the kidney using specialized designed
self retaining retractor. Laparoscopic retrieval sac was introduced through the minilaparotomy wound and
entrapped the kidney. Blind end of the lap. sac was open with scissors and packed with finely ground ice slush for
renal parenchymal hypothermia. Laparoscopic bull dog clamps were applied to renal artery and vein. When
necessary, intraoperative sonography is done to determine the margin of resection. The tumor was excised using
surgical knife. Any opened collecting system and vessels were meticulously closed in a watertight manner.
Results: From October 2000 to September 2006, VAMS partial nephrectomies on 83 patients were performed by
one surgeon (S.C. Yang). Mean age of the patients were 53.3 years old. Right sided cases outnumbered left side
cases by 54 to 29. Mean operative and cold ischemia time were 146 and 29.3 mins, respectively. Mean tumor size
was 2.54cm. Mean estimated blood loss was 156.5. Three patients had recurrent hematuria. Mean hospital stay
was 4.6 days.
Conclusions: VAMS-PN is a minimally invasive technique that combines the advantage of conventional
laparoscopic and traditional open partial nephrectomy. The ability to safely achieve and maintain renal surface
hypothermia using ice slush and to clamp renal vessels allows the surgeon more time for meticulous tumor
excision and renal repair while preserving renal function.

Table I. Clinical characteristics of patients undergoing VAMS partial nephrectomy

<table>
<thead>
<tr>
<th></th>
<th>VAMS-PN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of patients</td>
<td>83</td>
</tr>
<tr>
<td>Mean age (years)</td>
<td>53.3</td>
</tr>
<tr>
<td>Sex ratio (M : F)</td>
<td>32 : 51</td>
</tr>
<tr>
<td>Laterality (Rt : Lt)</td>
<td>54 : 29</td>
</tr>
<tr>
<td>Single kidney</td>
<td>7</td>
</tr>
<tr>
<td>BMI (kg/m2)</td>
<td>23.1 (19.4 – 28.5)</td>
</tr>
<tr>
<td>Mean tumor size (cm)</td>
<td>2.54</td>
</tr>
<tr>
<td>Mean total operative time (min)</td>
<td>146</td>
</tr>
<tr>
<td>Mean estimated blood loss (mL)</td>
<td>156.5</td>
</tr>
<tr>
<td>Mean warm ischemic time (min)</td>
<td>29.2</td>
</tr>
<tr>
<td>Mean hospital stay (days)</td>
<td>4.6</td>
</tr>
<tr>
<td>Time to full ambulation (days)</td>
<td>1.31</td>
</tr>
</tbody>
</table>

This work was supported by the Brain Korea 21 Project for Medical Science, Yonsei University
ABSTRACT 137

ABALATION OF BULL PROSTATES USING NOVEL BIPOLAR RADIOFREQUENCY ABLATION (RFA) PROBE

Lee Richstone, Matt Ziegelbaum, Zeph Okeke, Jonathan Kaye, Ernesto Reggio, Michael Ost, Louis R. Kavoussi, and Benjamin Lee

Purpose: Typical RFA devices employ monopolar electrodes susceptible to a cooling effect by nearby blood vessels, limiting the extent of tissue destruction. In addition, it is difficult to obtain areas of complete cell-kill with precise margins. We describe the use of a novel bipolar RFA system for the destruction of prostate tissue in an ex vivo bull prostate model. Preliminary studies have demonstrated that this system creates precise areas of ablation with limited spread of energy beyond the volume defined by the probe.

Methods: We employed a novel bipolar RF delivery system (Trod Medical, France) comprised of two concentric electrodes with different diameters, linked to a 500 KHZ generator. Current flows from the smaller (inner) to the larger (outer) probe coil, heating the tissue lying in-between (FIG 1). A total of 8 lesions were created in an ex vivo bull prostate model using 7mm and 10mm probes (4 lesions created per probe). Ablation was performed for 150 seconds. Temperature was recorded at the center of the lesion and at the periphery of the prostate. The lesions were examined histologically after formalin fixation. The distance from the lesion to the periphery of the gland was recorded. Power and impedance were recorded at 25 second intervals.

Results: Using the 7mm probe, the mean temperature at the center of the ablation zone and periphery of the gland was 82°C and 34°C, respectively. The mean distance from the edge of the lesion to the periphery was 5 mm. Impedance was 62 Ohm and power 4 Watts. With the 10mm probe, the mean central and peripheral temperature was 70°C and 41°C, respectively. The mean distance from the edge of the lesion to the periphery was 5 mm. Impedance was 78 Ohm and power 4.5 Watts. Histologically, all lesions demonstrated complete necrosis and tissue destruction. Normal prostate tissue without any evidence of tissue damage was visible within one high power field of the lesion (0.25 mm).

Conclusions: Bipolar RFA technology is a promising new ablative modality. In an ex vivo animal model, bipolar RFA is capable of producing lesions with precise margins. Spread of heat is limited, as evidenced histologically and by a significant temperature drop-off only 5mm from the edge of the ablated area. This technology holds promise in the treatment of benign and malignant urologic disease.
EYE TRACKING DURING LAPAROSCOPIC SURGERY: CORRELATION OF EYE MOVEMENTS WITH LEVELS OF EXPERIENCE

Lee Richstone, Ernesto Reggio, Zeph Okeke, Matthew Ziegelbaum, Benjamin R Lee, Louis R Kavoussi
New Hyde Park, NY

Introduction and Objective: Laparoscopy requires motor, cognitive as well as visual skills that are distinct from those required during open surgery. The way in which surgeons acquire these abilities is poorly understood. Eye tracking technology can provide insight into how surgeons perform laparoscopic procedures. We present our initial experience with eye tracking in the simulated and live operative environment.

Methods: The EyeLinkII eye tracker (SR Research, Canada) was used to record eye and papillary movements during laparoscopic tasks in a pelvic trainer. The headset employs three cameras to track and record eye movements using corneal reflection and pupil tracking at a sampling rate of 250Hz. A binocular representation of eye position is superimposed on the laparoscope image. Tasks ("rope transfer", "egg transfer", and chicken-skin "vesiourethral anastomosis") were performed by subjects categorized as novice, intermediate, or expert. Eye tracking was performed on all subjects during the initial attempt at each task, and at 2 additional times after defined amounts of practice. Data regarding eye position, fixation number/duration, saccade rate/velocity were recorded. Dynamic pupillary measurements were recorded, serving as a psychophysiological measure of cognitive workload. Eye tracking was also performed during live operations and during cystoscopy as a feasibility study.

Results: Significant differences in fixation and saccade parameters were observed between subjects of varying experience and after practice at a given task. Cognitive workload was associated with technically demanding aspects of the procedures and when subjects struggled with a given task. Eye tracking during live surgery and cystoscopy was feasible with minimal distraction to the operator. Unique eye tracking patterns were observed between expert and novice laparoscopists.

Conclusions: Eye tracking holds promise as a method to better understand the skills utilized during laparoscopic surgery. As an objective method to study surgeons while operating, this technology may have a significant role in skill assessment, surgical training and quality control in the future.
ABSTRACT 139

THE EFFECT OF RENAL CRYOABLATION ON RENAL FUNCTION FOR PATIENTS WITH A SOLITARY KIDNEY


Springfield, IL.

Purpose: Renal cryoablation has been shown to have negligible impact on renal function for patients presenting with normal renal function. However, the effect of renal cryoablation on patients with a solitary kidney has not been reported. The purpose of this investigation is to determine the creatinine level changes for patients with a solitary kidney who undergo renal cryoablation.

Materials and Methods: A retrospective review of patient charts was performed for patients who had undergone renal cryoablation. Only those patients with a solitary kidney were included provided they had known pre and postoperative creatinine levels. Due to the small size of the population, no statistical analysis was performed.

Results: Five patients were identified who had a solitary kidney and underwent renal cryoablation. The details of each patient, including tumor size and creatinine levels, are listed in the table below. The change in creatinine level was less than or equal to 0.2 mg/dL for all patients except one. This patient had a relatively large mass (3.7 cm) and had a preoperative creatinine level of 1.4 mg/dL. Importantly, no renal units were lost and no patient required dialysis, either temporary or long-term.

Conclusions: Renal cryoablation appears to have relatively minimal effect, as measured by serum creatinine levels, on the renal function of patients with solitary lesions, except in extreme cases. Although the creatinine level of one patient increased by 0.5 mg/dL, this patient has not required dialysis and was well served by renal cryoablation due to the very conformal and hence nephron-sparing nature of the procedure. These results demonstrate that for small masses (<3 cm) changes in creatinine are minimal for patients with a solitary kidney.

<table>
<thead>
<tr>
<th>Patient</th>
<th>Lesion size (cm)</th>
<th>Pre-op Creatinine (mg/dL)</th>
<th>Post-op Creatinine (mg/dL)</th>
<th>Change in Creatinine (mg/dL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3.0</td>
<td>1.3</td>
<td>1.4</td>
<td>0.1</td>
</tr>
<tr>
<td>2</td>
<td>2.3</td>
<td>1.1</td>
<td>1.1</td>
<td>0.0</td>
</tr>
<tr>
<td>3</td>
<td>2.5</td>
<td>1.0</td>
<td>1.1</td>
<td>0.1</td>
</tr>
<tr>
<td>4</td>
<td>3.7</td>
<td>1.4</td>
<td>1.9</td>
<td>0.5</td>
</tr>
<tr>
<td>5</td>
<td>1.0</td>
<td>1.3</td>
<td>1.5</td>
<td>0.2</td>
</tr>
</tbody>
</table>
ABSTRACT 140

ROBOTIC ASSISTED LAPAROSCOPIC SACROCOLPOPEXY AS TREATMENT FOR PELVIC ORGAN PROLAPSE

Bradley Schwartz, D.O., Timothy Powell, MD, Christopher Whelan, M.D.

Springfield, IL

Introduction and Objectives: Robotic assisted laparoscopic sacrocolpopexy (RALS) is a new surgical treatment for pelvic organ prolapse which secures the apex of the vagina to reduce apical vaginal vault defects. Limited literature exists on outcomes of this procedure. We present our initial experience with RALS.

Materials and Methods: Women with vaginal vault prolapse and significant apical defects following hysterectomy were offered RALS. Chart review was performed to analyze operative and perioperative data, including urodynamics (UDS) and grade of pelvic organ prolapse (Baden-Walker classification) before and after surgery. Data was analyzed with comparison of pre- and post surgical data.

Results: From July 2005 through June of 2006, 14 patients underwent RALS. Mean age was 63.3 years. Blood loss was negligible with no change in post-operative mean hemoglobin. Average operative time, including robotic docking, was 2 hours, 56 minutes. Average times for cases 1-5, 6-10, and 11-14 were 3 hours 19 minutes, 2 hours 55 minutes, and 2 hours 29 minutes, respectively. Mean follow-up was 6 months. Every patient was discharged the day after surgery. All patients had anterior and posterior (AP) prolapse prior to RALS, with grade 2-3 pelvic organ prolapse. After surgery, no patients had apical vaginal prolapse, however, each continued to have grade 2-3 cystocele and rectocele. UDS were not significantly changed post-operatively. There were no operative complications or conversions. One patient had a small bowel obstruction 5 days after surgery. Laparotomy revealed a loop of small bowel posterior to the Y-graft. Of the 14 patients, 6 have since undergone AP repair, 7 await AP repair, and one opted for conservative management.

Conclusions: RALS is effective to repair apical vaginal defects in patients with significant pelvic organ prolapse. Blood loss is minimal and complications are few. Operative times decrease with experience. Cystocele, rectocele and UDS remain essentially unchanged by RALS. Most if not all patients with cystocele and rectocele will require further vaginal reconstruction after RALS. Greater follow-up and numbers are needed to further establish the role of this procedure.
ADVANCED LAPAROSCOPIC URETERAL RECONSTRUCTION INCLUDING ILEAL INTERPOSITION: COMPARISON WITH THE OPEN EXPERIENCE

Robert J Stein, Matthew N Simmons, Christopher J Weight, Amr F Fergany, Jason M Hafron, Monish Aron, Mike M Nguyen, Troy R Gianduzzo, Jose R Colombo, Jihad H Kaouk, Inderbir S Gill, Mihir M Desai, Cleveland, OH

Introduction: Non-endoscopic management of benign or malignant ureteral pathology has consisted of open techniques including ureteroneocystostomy with boari flap or psoas hitch, ureteroureterostomy, or ureteral ileal interposition. We present our experience with laparoscopic approaches for each of these complex reconstructive procedures and compare the results with our open experience.

Methods: Ureteroureterostomy, psoas hitch ureteroneocystostomy, or boari flap ureteroneocystostomy was performed on 31 patients using an open approach and 12 patients using a laparoscopic approach. Ileal interposition was carried out on 8 patients (10 renal units) using an open approach and 6 patients laparoscopically. Intraoperative and postoperative data were compared between open and laparoscopic techniques.

Results: Blood loss and hospital stay were significantly lower for the group undergoing laparoscopic ureteroureterostomy, psoas hitch, or boari flap compared to open. (Table I) One patient in the open group developed a recurrence of stricture that was treated endoscopically. No significant differences in perioperative results were found between the laparoscopic and open ileal interposition groups possibly due to small sample size. (Table II) One major complication, enteric anastomotic leak, occurred in the laparoscopic group after reestablishment of bowel continuity intracorporeally. We now isolate our bowel segment through a small incision which is variably positioned in order to provide access for other portions of the procedure if necessary. There were no recurrences for either group.

Conclusions: Compared to open surgery, complex laparoscopic ureteral reconstruction decreases hospital stay and blood loss. Ileal interposition is an advanced laparoscopic procedure, further experience with this modality is needed in order to compare it with the open technique.

<table>
<thead>
<tr>
<th>Table I: Ureteroureterostomy, Psoas Hitch, Boari Flap</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimated blood loss (cc)</td>
</tr>
<tr>
<td>---------------------------</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Hospital stay (days)</td>
</tr>
<tr>
<td>Complications</td>
</tr>
<tr>
<td>Recurrences</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table II: Ileal Interposition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operative time (min.)</td>
</tr>
<tr>
<td>------------------------------</td>
</tr>
<tr>
<td></td>
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<tr>
<td>Estimated blood loss (cc)</td>
</tr>
<tr>
<td>Hospital stay (days)</td>
</tr>
<tr>
<td>Complications</td>
</tr>
</tbody>
</table>
HIDDEN COSTS IN PROSTATE CANCER TREATMENTS

Stefan Thueroff; Christian Chaussy, Katharina Herzog
Department of Urology, Krankenhaus Muenchen-Harlaching, Germany

Introduction: At least 8 different therapy modalities for the treatment of prostate cancer are widely spread over Europe and used according to the preference of each user. More and more cost calculations by administrative systems are influencing the decision for one or the other modality. We want to show significant influence of often unmentioned factors on the cost profile of a therapy.

Methods: A critical analysis was performed to identify the influence of such hidden cost-inducing factors as: “indication range” resulting in therapies/year, necessity of “treatment in sterile OR”, “learning curve” inducing additional costs, “treatment time” and “number of treatment connected staff”, “sterilisation costs”, “special pre- or postoperative planning”, and “treatment controls or intensive care”. The possibility of “out patient” treatment is shown for each therapy.

Results:

<table>
<thead>
<tr>
<th>PCa Treatments</th>
<th>% PCa as first therapy</th>
<th>Learning curve treatments</th>
<th>Tx in OR</th>
<th>Treat time (min)</th>
<th>Staff for treatment doc/nurse/anesthesist</th>
<th>hours manpower (h)</th>
<th>Special pre-/post procedures</th>
<th>Steril-/Legalsation costs</th>
<th>mobile service/out patient costs / treatment (RPE=100 %)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lap surgery</td>
<td>45</td>
<td>200</td>
<td>Yes</td>
<td>240</td>
<td>2/3/1</td>
<td>24</td>
<td>post OR</td>
<td>Yes / No</td>
<td>No</td>
</tr>
<tr>
<td>Robot surgery</td>
<td>45</td>
<td>100</td>
<td>Yes</td>
<td>240</td>
<td>2/3/1</td>
<td>24</td>
<td>post OR</td>
<td>Yes / No</td>
<td>No</td>
</tr>
<tr>
<td>Cryo surgery</td>
<td>40</td>
<td>100</td>
<td>Yes</td>
<td>180</td>
<td>2/3/1</td>
<td>18</td>
<td>plan</td>
<td>No / No</td>
<td>Yes / No</td>
</tr>
<tr>
<td>Brachy LDR</td>
<td>30</td>
<td>100</td>
<td>Yes</td>
<td>180</td>
<td>3/2/1</td>
<td>18</td>
<td>plan/contr</td>
<td>No / Yes</td>
<td>Yes /Yes</td>
</tr>
<tr>
<td>Brachy HDR</td>
<td>20</td>
<td>50</td>
<td>Yes</td>
<td>240</td>
<td>3/3/1</td>
<td>28</td>
<td>plan/contr</td>
<td>No / Yes</td>
<td>No</td>
</tr>
<tr>
<td>Ext. radiation</td>
<td>30</td>
<td>50</td>
<td>No</td>
<td>300</td>
<td>2/1/0</td>
<td>15</td>
<td>plan</td>
<td>No / Yes</td>
<td>No / Yes</td>
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<tr>
<td>TURP+Ablatherm</td>
<td>65</td>
<td>10</td>
<td>No</td>
<td>150</td>
<td>1/1/1</td>
<td>9</td>
<td>No</td>
<td>Yes / No</td>
<td>Yes /Yes</td>
</tr>
<tr>
<td>Ablatherm mono</td>
<td>65</td>
<td>10</td>
<td>No</td>
<td>120</td>
<td>1/1/1</td>
<td>6</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Conclusion: This analysis shows topics, not to be forgotten, before including / excluding prostate cancer treatments into the setup of a urological department. The “hidden costs” behind a therapy (disposables, service contracts, learning curve, training in use of ionising material, number of staff needed, OR time, room availability, pre- and postoperative - not avoidable - preparations or controls) should be known, calculated, and taken in account.
MULTIMODAL COMBINED THERAPEUTIC APPROACH IN METASTATIC PROSTATE CANCER CAN CAUSE LONG-TERM COMPLETE REMISSION

Stefan Thueroff, Christian Chaussy, Andreas Neumayr
Department of Urology, Krankenhaus Muenchen-Harlaching, Germany

Introduction: Complete remission of metastatic prostate cancer is extremely rare, and spontaneous remission is not described at all. Progression after hormonal ablation – as standard treatment - is 100 %. The point of progression depends upon the aggressiveness of the primary tumor. Complete therapy induced remission of disease > 5 years is extremely unusual. We searched for cases of patients with complete cancer remission (PSA = 0 + negative bone scan + negative biopsies + symptom free) after combined treatment with high intensity focused ultrasound (HIFU by Ablatherm®), permanent hormonal ablation and metastasis radiation, with a follow-up > 5 years.

Methods: Review of our database of cases since 1996 included 37 patients treated with metastatic cancer and permanent hormonal ablation. Patients presented with biopsy-proven prostate cancer and positive bone scans. HIFU by Ablatherm® was applied in these cases under the strategy of neoadjuvant local debulking of the primary tumor, to avoid local morbidity. Radiation for the bone metastasis and hormonal ablation was performed to stop systemic progression.

Results: We found 2 patients showing complete remission with a follow up of 8 years. Both had T3 prostate cancer with positive bone scans.

Conclusion: Local HIFU with Ablatherm® combined with adjuvant hormonal ablation and radiation of bigger metastasis seems to have induced a positive systemic reaction, which led to complete remission of metastatic disease. Induction of the immunological system by cancer cell coagulation and primary tumor mass destruction in combination with systemic tumor growth inhibition by hormonal ablation should be discussed as possible reason of this interesting, and unexpected, result.
ABSTRACT 144

HIGH POWER (80 W) POTASSIUM-TITANYL-PHOSPHATE (KTP) LASER PHOTOSELECTIVE VAPORIZATION PROSTATECTOMY (PVP) FOR REFRACTORY URINARY RETENTION SECONDARY TO BENIGN PROSTATIC HYPERPLASIA (BPH)

Jeremy B. Tonkin, Motoo Araki, Po N. Lam, Daniel J. Culkin, Pamela E. Fox, Glenn M. Sulley and Carson Wong

Department of Urology, University of Oklahoma Health Sciences Center, Oklahoma City, OK
920 Stanton L. Young Blvd., WP 3150, Oklahoma City, OK

Introduction: Pre-operative urinary retention can increase risks for sepsis and hemorrhage following transurethral prostatectomy. We evaluate KTP laser PVP in patients with refractory urinary retention secondary to BPH.

Methods: We prospectively evaluated our initial 12-month experience with KTP laser PVP. Only patients who presented with refractory urinary retention secondary to BPH were included. Peri-operative antibiotics were provided. Under general anesthesia, transurethral PVP was performed using an 80 W KTP side-firing laser system. Voiding trials were performed two hours post surgery; and if unable to void, a urethral catheter was replaced.

Results: Twenty-six of 160 consecutive patients were identified, having a mean prostate volume of 101 ± 51 cm³ and a mean American Society of Anesthesiologists (ASA) risk score of 2.3 ± 0.7. The mean laser time and energy usage were 51 ± 38 minutes and 146 ± 114 kJ, respectively. Peri-operative serum sodium and hemoglobin did not change significantly. All were performed as outpatient procedures, with the majority of patients catheter-free at discharge. Four patients required catheter drainage for one week. One patient had persistent hematuria for greater than one week. Three patients had persistent urinary retention due to detrusor failure. One patient developed a bladder neck contracture that required dilation. No urethral strictures or urinary incontinence were noted. All patients were able to discontinue their prostate medications following surgery. Mean International Prostate Symptom Score (IPSS) decreased significantly from 29 to 17, 13, 10, 10 (*p<0.05) at 1, 4, 12 and 24 weeks, respectively. Maximum flow rate and post void residual values also showed improvement.

Conclusion: Our initial results demonstrate that KTP laser PVP is safe and effective in the treatment of refractory urinary retention secondary to BPH. Preoperative urinary retention does not necessarily predispose one to increased risks of sepsis, hemorrhage or prolonged catheter drainage post surgery. Continued follow-up is in progress.

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<td>Mean AUASS</td>
<td>25 ± 7</td>
<td>14 ± 8*</td>
<td>11 ± 9*</td>
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<td>Mean QOL score</td>
<td>5 ± 1</td>
<td>2 ± 1*</td>
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<td>Mean Qmax (cc/sec)</td>
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<td>14 ± 6</td>
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A STRUCTURAL MODEL OF THE URINARY BLADDER WALL: Effects of connective tissue remodeling

Silvia Wognum and Michael S. Sacks
Department of Bioengineering, University of Pittsburgh, Pittsburgh, PA

Introduction: Under pathological conditions such as spinal cord injury (SCI), the routine function of the urinary bladder, storing urine and voiding, becomes compromised. In addition to functional deficiencies, bladder pathologies involve changes in tissue morphology and mechanical properties, suggesting a strong relation between structure and function. A structural constitutive model of the urinary bladder wall is needed to clarify this relation and to understand how functional changes in various components, i.e., mainly collagen and smooth muscle (SM), produce observed changes in bladder function. Our overall goal is to develop a structural constitutive model that predicts tissue remodeling under altered biomechanical conditions. The bladder remodeling framework is given in the figure. The specific goal of this project is to determine the mechanical contribution of the ECM to the total tissue behavior.

Methods: Mathematical framework: The strain energy, and hence the total tissue stress, is assumed to be the sum of the contributions of the components (ECM and SM), based on volume fractions. The ECM is described by the structural constitutive model as developed by Sacks. Decellularization: The ECM is separated from the intact tissue by a decellularization procedure using different detergents. Biaxial testing: The multiaxial mechanical properties of the tissue are determined in intact and decellularized state. Square test specimens from (decellularized) bladders from female Sprague-Dawley rats are tested in modified Krebs solution to max. 30 kPa in the biaxial testing device. Collagen architecture: Quantitative morphology of intact bladder wall is determined. The orientation of collagen fibers in the ECM is determined using small angle light scattering (SALS) on decellularized bladder samples.

Results: Biaxial testing shows that both the intact tissue and the ECM exhibit significant anisotropy. The collagen orientation is found to be along the longitudinal axis, which is the same preferred orientation of the smooth muscle cells as was determined previously. The stress-stretch data of the ECM is referred back to the intact tissue state to be incorporated in the structural model.

Discussion: A structural constitutive model for the urinary bladder wall can be derived from experimental stress-stretch data from intact tissue and from ECM via decellularized tissue. The ECM stress-stretch data will be fit to the ECM-part of the model to determine the ECM material parameters, and the intact data will be fit to the total model to determine the smooth muscle material parameters. A constitutive equation for smooth muscle remains to be determined. The model will predict changes in mechanical properties as a result of structural changes (i.e., in mass fraction or orientation) as a result of SCI.
URETHRAL REMODELLING WITH A NEW, DYNAMIC, SITE-SPECIFIC TEMPORARY STENT AS A SIMPLE AND EFFECTIVE APPROACH IN THE TREATMENT OF RECURRENT BULBAR URETHRAL STRICTURE DISEASE

Daniel Yachia*, Zeljko Markovic #
*Allium Medical Inc.,
# Dept of Radiology. Central Clinic of Serbia. Belgrade. Serbia

Urethral strictures in general, and bulbar strictures in particular, are commonly treated by dilation or internal urethrotomy, which are noncurative, palliative methods. A recent study in the USA showed that, although open surgical urethroplasty is the accepted gold standard treatment, most urologists do not perform urethroplasty but prefer to perform palliative methods. The survey showed that the most frequently used methods are dilation (92.8%) and internal urethrotomy (85.6%). Because urethroplasty can be successful (up to 90%) only in experienced hands who frequently perform such surgery, the average urologist prefer to use palliative methods and in more complex cases they prefer to refer their patients to urethroplasty experts. Since 1988, various types of urethral stents have been used for the treatment of bulbar urethral stricture disease.

Common problems seen with the first generation permanent or temporary bulbar stents are:
- Sphincteric dysfunction when deployed near the external sphincter (incontinence);
- Reactive tissue proliferation at the ends of the stent (candy-wrap effect) caused by friction between the end of the stent and the wall of the urethra;
- The smaller than the bulbar urethral caliber (temporary stents);
- Limitation of use of permanent stents in traumatic strictures or after urethroplasty Failures; and
- Difficult explantation of the permanent stents.

The Bulbar Urethral Stent used in this study was specifically designed to fit the anatomy of this urethral segment, taking into consideration the large caliber of its lumen and the vicinity of the external sphincter. This stent has a main body which expands to 45F, a slightly conical sphincteric end which has a very low radial force, and a low radial force downstream end to reduce the friction of this end with the urethra.

Since the end of 2003, this new stent was inserted into the bulbar urethra of 24 unselected patients who had frequently recurring bulbar strictures of various etiologies, including post traumatic ones. The stents were left indwelling 8-14 months (mean 11 months) for urethral remodeling, and then removed. During this period, none of the stents occluded by tissue proliferation. Average follow-up after stent removal was 22 months (range 20-26 months). Removal of the stent was very easy. No incontinence was observed, even when the stent was situated immediately below the sphincter. Only in 2 patients was a recurrence observed at 12 and 18 months after stent removal.

This large caliber bulbar stent can be easily inserted, allowing any urologist to use it in recurrent bulbar urethral strictures.
ABSTRACT 147

ORGAN-SPECIFIC DYNAMIC UROLOGICAL STENTS:
AN ENGINEERING CHALLENGE

Daniel Yachia, M.D.
Allium Medical Inc.

All current stents inserted either temporarily or permanently into any tubular structure in the body are “static” devices. They are intended to keep the tubular structure open. Not only that they do not participate to the function of the organ they are inserted; on the contrary they may even disturb its function when the hosting organ is a functioning one.

A major part of the urinary system is composed from tubular structures having various lumen caliber sizes, shapes and functions. The ureter has a peristaltic function and an antireflux mechanism at the uretero-vesical junction; the prostatic urethra changes its shape during voiding and loses its round shape in case of prostatic enlargement; and the bulbar urethra is situated immediately below the external sphincter. As such, the use of cylindrical stents with equal radial force all along their body causes several problems.

The most common problems seen with the current cylindrical stents are:

- Migration of the self-expanding large caliber ureteral stent;
- Vesico-ureteral reflux when the stent is deployed in the orifice;
- Sphincteric dysfunction when the stent is deployed near the external sphincter (incontinence – prostatic and bulbar urethral stents);
- Tissue proliferation at the ends of the stent (candy-wrap effect);
- Discomfort because of shape mismatch between the urethral lumen and the stent (large caliber prostatic stents);
- Discomfort because of stent stiffness or sharp edges (bulbar stents); and
- Difficult removeability of large caliber stents through small natural openings.

All these problems could be solved by close cooperation between the user (urologist) and the mechanical / bio-medical engineers to create fully covered, removable stents tailored to the shape and function of each of the 3 sites in the urinary tract. Figure 1 depicts the shape and the characteristics of the new dynamic ureteral stent as an example.

UNRAVELING LINE ANCHOR

NiTi SKELETON

SOFT END BODY

Figure 1.
Da Vinci ROBOT ERROR AND FAILURE RATES: SINGLE INSTITUTION EXPERIENCE ON A SINGLE 3-ARM ROBOT UNIT OF OVER 700 CONSECUTIVE ROBOTIC-ASSISTED LAPAROSCOPIC RADICAL PROSTATECTOMIES

Zorn KC, Gofrit ON, Orvieto MA, Mikhail AA, Galocy RM, Zagaja GP, Shalhav AL

Section of Urology, University of Chicago Pritzker School of Medicine, Chicago, Illinois

Introduction: Previous reports have suggested that a 2-5% device failure rate (FR) be quoted when counseling patients for robotic-assisted laparoscopic radical prostatectomy (RLRP). We sought to evaluate our FR using the da Vinci system (DVS).

Methods: Since February 2003, over 800 RLRPs have been performed at our institution using a single, 3-armed robotic unit. Analysis of a prospective database was performed to determine the device FR and whether it resulted in case abortion or conversion. Intuitive Surgical provided the authors with data concerning the system’s performance, including its system fault rate. Error messages were classified as recoverable and nonrecoverable faults.

Results: Between February 2003 and November 2006, 725 RLRP cases were available for evaluation. There were no intra-operative device failures which resulted in a case conversion (0%). Technical errors resulting in surgeon handicap occurred in 3 (0.4%) cases. Four (0.5%) patients had aborted procedures due to system failure at initial setup prior to entering the operating room. Data analysis retrieved from the da Vinci console reported on a total of 807 procedures since 2003. Only 4 cases (0.4%) were reported from the Intuitive Surgical database to result in either an aborted or converted case, which compares favorably to our results. Since the last computer system upgrade (September 2005), the mean recoverable and nonrecoverable faults rates were 0.21 and 0.05 faults/procedure, respectively.

Conclusions: For all the advanced features the da Vinci surgical system offers, it is surprisingly reliable. Throughout our RLRP experience, device failure resulted in case conversion, abortion and surgeon handicap in 0%, 0.5% and 0.4% of procedures, respectively. As such, a lowered device FR of 0.5% should be used when counseling patients undergoing RLRP. A policy should also be enforced to ensure that the DVS be completely setup prior to the patient entering the operating room to avoid unnecessary general anesthesia.
ABSTRACT 201
A PASSIVE TECHNIQUE TO IDENTIFY STONE COMMUNITION DURING SHOCK WAVE LITHOTRIPSY

Michael R. Bailey¹, Neil R. Owen¹, Oleg A. Sapozhnikov¹,²

¹Center for Industrial and Medical Ultrasound, Applied Physics Laboratory, University of Washington, Seattle, WA, USA
²Department of Acoustics, Physics Faculty, Moscow State University, Moscow, 119992, Russia

Introduction and Objectives: Clear feedback on whether a stone has fractured or is fully comminuted would be beneficial in shock wave lithotripsy (SWL). We describe here a passive technique to monitor comminution, where acoustic scatter from stones is measured and analyzed. The basic theory is that smaller structures vibrate at a higher pitch. As applied to SWL, when struck with a shock wave (SW) the frequencies at which stones vibrate will rise as the stones become smaller.

Methods: Spherical cement stones (diameter = 9.8 mm) were held in a plastic pipette at the focus of an electrohydraulic lithotripter patterned after the Dornier HM3. The first phase of the experiment was a pre-SW measurement of acoustic scatter from 5 SWs triggered 1 minute apart. Second was the application of 20, 50, or 100 SWs (n=5 stones for each) at a rate of 0.5 Hz. Third was an inactive period of 5 minutes; allowing bubbles to dissolve. Fourth was a post-SW measurement conducted identically to the first phase. Pre-SW and post-SW measurements were made with a spherical receiver (radius of curvature = 150 mm, diameter = 50 mm) and subjected to an analysis where energy was calculated in specific frequency bands. Particles were dried after the experiment and then sieved with 3 mm, 2 mm, and 1 mm screens to measure percent comminution.

Results: Waveforms measured pre-SW were repeatable, and a clear difference was observed when compared to post-SW waveforms. The ratio of energy calculated in specific frequency bands, between 0 MHz and 3 MHz, show that energy shifted to higher frequencies as the stones were broken into smaller pieces. Measurements of percent comminution show that 20, 50, and 100 SWs produced a percentage of particles smaller than 2 mm of 30%, 78%, and 93%, respectively.

Conclusions: Experimental results show a difference between intact and fractured stones that was detectable with a ratio of energy in the frequency domain. This result provides the basis for a feedback system to help an urologist when deciding to cease or continue a lithotripsy procedure. Further, the shift in energy to higher frequencies, as more SWs were applied, was related to more complete comminution. Therefore, this feedback could potentially be used to distinguish when stones are smaller than 2 mm.

[Work supported by NIH DK43881, DK55674, NSBRI SMS00402, and RFBR 05-02-16987.]
ABSTRACT 202

BIOMECHANICS OF INCONTINENCE

Prashanth Balasubramanian\textsuperscript{1}, Seoggwan Kim\textsuperscript{1}, Arthur G Erdman\textsuperscript{1}, Gerald W Timm\textsuperscript{2},

\textsuperscript{1}Department of Mechanical Engineering, University Of Minnesota
\textsuperscript{2}Department of Urological Surgery, University of Minnesota

Introduction: Previous studies have described urinary incontinence (UI) occurring during physical activities in young female athletes which was found to be surprising and is the motivating factor behind this particular group’s research efforts. Urinary incontinence causes women to withdraw from sports participation and may contribute to physical inactivity. In a survey study conducted at the university by one of the students in the group it was found that jumping and other vigorous activities were the primary causes of urine leakage in the case of young female athletes. A mathematical explanation of urinary incontinence in female athletes due to jumping has been attempted using finite element (FE) method.

Methods: A model of the female pelvic area was constructed and is being refined using finite element software Abaqus. Effects of varying impact forces exemplified by a jump height and bladder volume on urine leakage are being investigated. The geometric model chosen for initial analysis is a simplified version of the actual pelvic model for ease of convergence of solution. Fluid interaction within the bladder was modeled and studied.

Results: The current model (shown below in fig 1) is used to predict the effect of jumping height on the amount of urine leakage. Jumping height of 0.1, 1, 2 and 3 feet is being modeled. The velocity of impact is calculated from the simple equations of motion. The effect of the stiffness of the muscle has also been studied. The next generation model, on which work is being carried on (shown in fig2), will be more accurate in terms of structure and will be able to predict the effect of vigorous activity on the urethral opening in the same way as the current model.

Conclusion: Jumping height has a large effect on the opening of the urethra. Stiffness of the perineum muscle and the urethral sphincter has a great influence as well. Work on the next generation model is currently being carried out by increasing the complexity of the model in steps and studying the effect of various organs, muscles and ligaments in greater detail.
ABSTRACT 203

COMPARISON OF BLADE TEMPERATURE DYNAMICS AFTER ACTIVATION BETWEEN HARMONIC ACE AND ULTRACISION HARMONIC SCALPEL LCS-K5

Gaurav Bandi, MD; Charles C. Wen, MD; Eric R. Wilkinson, Sean P. Hedican, MD; Timothy D. Moon, MD and Stephen Y. Nakada, MD

Division of Urology, Department of Surgery, University of Wisconsin, Madison, WI

Aim: To compare blade temperature of the vibrating blade of the newer generation Harmonic Ace to the older generation Ultracision Harmonic Scalpel LCS-K5.

Material and methods: Two different harmonic scalpel blades (LCS-K5 and the Ace, Ethicon Endo-Surgery Inc., Cincinnati, OH) were applied to 3mm strips of fresh chicken breast at room temperature. The temperature elevation of the heated blade from each harmonic scalpel was estimated at every 0.5 second interval using a thermocouple device (Luxtron FOT Lab Kit, Luxtron Corp., Santa Clara, CA). Each device was tested at power settings of 3 and 5 after activation for one to five seconds. Following activation the device was allowed to passively cool to 30°C each time before reactivation.

Results: Compared to the older generation device, the Harmonic Ace was associated with a significantly higher increases in the temperature of the oscillating blade at power level 5 at all times of activation (1-5 seconds) and at power level 3 at longer times of activation (3-5 seconds). The newer device also took a significantly longer time to reach peak temperatures and maintained longer blade hyperthermia times (blade temperature more than 45°C) after activation for more than 3 seconds at both power levels.

Conclusion: Although, potentially more efficient in tissue dissection, the Harmonic Ace is associated with significant increases in blade temperatures especially after prolonged activation which has a potential for collateral damage. Clinical correlation will be necessary.
Objective: To determine the current practice patterns in the use of ablation technology for the management of small renal masses at academic urology departments.

Methods: An email survey was sent to 112 academic urologists (1 from each residency program) specializing in minimally invasive management of renal cancer. The survey consisted of 13 focused questions pertaining to use of ablation technology and 4 case scenarios of patients with small renal masses. The responses were analyzed to determine practice trends.

Results: The response rate was 61%. Ablation was offered by 93% of the academic urology departments, cryoablation was more frequently used (77%) than radiofrequency ablation (51%). Lack of sufficient efficacy data was the most common reason (80%) for not offering ablation. The maximum size limit for offering ablation was 3cm by 34% and 4cm by 54% of the respondents. A combined approach utilizing both radiologist and urologist was most commonly employed (51%). Most urologists (67%) utilized both laparoscopic and percutaneous technique based on the tumor and adjacent organ location. Intraoperative ultrasound was universally employed while doing the laparoscopic technique; however, the ultrasound was usually performed by the urologist (95%). CT scan was the most frequently employed imaging modality for percutaneous ablation (78%) and for surveillance of recurrent disease (80%). In a young healthy patient, most urologists recommend laparoscopic partial nephrectomy for the management of a small peripheral renal mass (90%) and laparoscopic radical nephrectomy for a small hilar mass (66%). Laparoscopic assisted ablation was most commonly recommended (54%) for anteriorly located peripheral renal mass in an elderly patient with comorbidities.

Conclusion: This study suggests that laparoscopic and percutaneous ablation is frequently offered by most urologists at academic institutions in carefully selected patients for management of small renal masses (<4cm). Once more long-term data are available; this information may be useful in formulating guidelines for the management of this disease.
ABSTRACT 205

EVALUATION OF DURABILITY OF LATEST GENERATION FLEXIBLE URETEROSCOPIES

Vincent G Bird*, Robert I Carey†, Christopher S. Gomez*, Aldiana Soljic*

* University of Miami Department of Urology, Miami FL
† Urology Treatment Center, Sarasota, FL

Introduction and Objective: The most recent generation of flexible ureteroscopes offer excellent visualization and maneuverability. Though these improved features may add to clinical success, there remains concern regarding durability of these fragile instruments. Durability is of critical importance in that it factors greatly into the cost of the performance of flexible ureteroscopy. There is little data regarding durability of recently manufactured models. Our objective is to determine whether new improvements in ureteroscope design, including use of a laser resistant ceramic, improve overall durability.

Methods: We maintain a prospective database of all patients undergoing ureteroscopy. This database includes extensive parameters relating to patient demographics, pathologies treated, ureteroscope being used, ancillary devices used, and damage incurred. All flexible ureteroscopes received new from manufacturers were studied for overall durability (total scope usages/damage incurred); they included: DUR™8 (Gyrus/ACMI, Stamford, CT), DUR™8 Elite (Gyrus/ACMI, Stamford, CT), Flex-X™ (Storz, Charlton, MA), and Flex-X2™ (Storz, Charlton, MA), the lattermost a recently introduced ureteroscope that contains Laserite™, a laser resistant ceramic coating intended to protect the distal tip of the ureteroscope from laser damage.

Results: We evaluated a total of 983 cases involving use of 1111 ureteroscopes. We identified 7 newly introduced flexible ureteroscopes: DUR™8 (2), DUR™8 Elite (1), Flex-X™ (2), and Flex-X2™ (2). Ureteroscope manufacturer/model, total uses of the ureteroscope, and incurred damage resulting in return of the ureteroscope to the manufacturer were as follows:

- DUR™8 /40/ laser damage
- DUR™8 /48/ torquing-laser damage,
- DUR™8 Elite /47/ torquing (not returned)
- Storz™ Flex-X™ /47/ torquing
- Storz™ Flex-X™ /48/ laser damage-deflection loss
- Storz™ Flex-X2™ /61/ torquing
- Storz™ Flex-X2™ /59/ damage during sterilization (returned for evaluation by manufacturer engineers)

Conclusions: New ureteroscopes from both manufacturers performed well. Damage often occurs as a result of inadvertent laser firing, shaft torquing, and loss of deflectability. Preliminary results suggest that Laserite™, used in the manufacture of the Storz™ Flex-X2™ flexible ureteroscope, may mitigate against laser damage. Nonetheless, the new Storz™ Flex-X2™ ureteroscopes also are susceptible to torquing, resulting in fiber damage, and loss of deflectability. One DUR™8 Elite ureteroscope is still in use at the time of this submission. Its total durability is still being assessed.
ABSTRACT 206

CYSTOLITHOLAPAXY: AN INNOVATIVE APPROACH SIMPLIFYING A CUMBERSOME TECHNIQUE

Daniel I Brison, Hossein Sadeghi-Nejad, Mark Jordan, Pedram Ilbeigi

Introduction and Objective: Transurethral cystolitholapaxy is a minimally invasive approach that often employs laser technology in the treatment of bladder calculi. It is best performed using 23-French continuous endoscopes that allow optimal visualization and positioning of the laser fiber. Most institutions however utilize smaller conventional endoscopes or large resectoscopes that allow for continuous flow. These common access techniques are fraught with technical difficulties and have prolonged operative times. We describe an innovative technique that utilizes a small catheter passed adjacent to a 22-French cystoscope in order to provide a continuous flow environment without the need to use larger resectoscopes or purchase additional equipment. In this study, we compare this approach to other commonly utilized techniques.

Methods: During an 18-month interval, 21 patients underwent transurethral treatment of bladder calculi at three different institutions. Cystolitholapaxy was performed using 1000µm Holmium (Ho-YAG) laser fibers facilitated by one of three transurethral access methods depending upon the preference of the senior surgeon. Patients were stratified into three groups: 22-Fr cystoscope only (Group 1), 26-Fr resectoscope with continuous flow (Group 2), red rubber catheter + 22-Fr cystoscope (Group 3).

Results: Group 3 showed a significant reduction in operative time (43.3 ± 9.6 min vs. 111.4 ± 39 min, p < 0.001) when compared to Group 2 (resectoscope with continuous flow) with comparable stone burden. When compared to Group 1 (22-French cystoscope only), differences in operative times did not reach statistical significance (43.3 ± 9.6 min vs. 72.5 ± 37 min), but there was a trend toward shorter operative times for Group 3 despite treating larger stones (3.53 cm³ vs. 2.5 cm³, (p<0.01).

Conclusion: The concomitant use of small catheters expedites these operations by providing an environment that allows optimal bladder distention, continuous flow, and excellent visualization with few interruptions. By using smaller caliber endoscopes, the Holmium laser fiber can be reliably seen in the center of the view-port, facilitating expedient stone fragmentation.
PULSED HIGH INTENSITY FOCUSED ULTRASOUND (HIFU) AT 3.0 MHZ AS SALVAGE TREATMENT OF RECURRENT PROSTATE CANCER

Christian Chaussy¹, Stefan Thueroff¹, F. Murat², Albert Gelet²

¹Department of Urology, Krankenhaus Muenchen-Harlaching, Germany
²Department of Urology, Edouard Herriot Hospital, University of Lyon, France

Introduction: Recurrent prostate cancer after surgery, radiation, hormonal ablation or multiple local pretreatments is a therapeutic problem: as a small tumor volume, within scar, fibrotic tissue – visible in transrectal ultrasound and proven by biopsy – it can be treated locally, noninvasively, in one session by HIFU through a noninvasive rectal approach.

Methods: Patients with biopsy-proven recurrent prostate cancer were treated by transrectal HIFU at 3.0 MHz (Ablatherm®, EDAP France). Primarily 8 patients had radiation (R), 30 had radical surgery (S), 36 hormonal ablation (HA), and 40 had multiple local pretreatments (M) as failed therapies. All patients were in local (and some even in systemic) progression. Local tumor volumes were small (∅: S = 4cc / R = 15cc / HA = 17cc / M = 8cc). Initial Gleason sum showed typically aggressive recurrent cancer with a Gleason >=7 in: S = 66%, R = 77%, HA = 69%, M = 79%. After a total treatment time of S = 48min, R = 91min, HA = 128min, M = 68min, patients were discharged fast and observed by PSA, biopsies and complaint score.

Results: Follow-up biopsies were negative in S = 67%, R = 66%, HA = 60%, M = 63% and local tumor volume was reduced > 90% in all other cases. Side effects were 8 cases of recto-urethral fistula and in 20 - 39% a low-medium grade stress incontinence. The rate of side effects increased with the number of local pretreatments.

Conclusions: HIFU by Ablatherm® is shown to be locally high effective, with low morbidity and tolerable side effects. In nonobstructive, small volume tumours, it might be applied as an “out patient procedure.”
ABSTRACT 208

A COMPARATIVE ANALYSIS OF OPEN, LAPAROSCOPIC, AND ROBOTIC RADICAL CYSTECTOMY FOR BLADDER CANCER

Oussama Elhage¹, Declan Murphy¹, Ben Challacombe¹, Peter Rimington², Mohammad S Khan¹, Prokar Dasgupta¹

¹Department of Urology, Guy’s & St Thomas Hospitals NHS Foundation Trust and King’s College London School of Medicine, London, UK
²Department of Urology, Eastbourne District General Hospital, Eastbourne, UK

Introduction: With advancements in technology open radical cystectomy (ORC) is being challenged by the minimally invasive options of laparoscopic (LRC) and robotic radical cystectomy (RRC). This is the first reported comparison of the three techniques.

Patients and methods: 30 age-matched patients (10 in each group) had ORC, LRC or RRC and ileal conduit diversion by three surgeons within a team over a 5 year period. Median data are presented in each category.

Results:

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<th>Op time- mins</th>
<th>Blood loss-mls</th>
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<th>Hosp stay-days</th>
<th>Recovery- wks</th>
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* DF=disease free either local or systemic

Conclusions: RRC and LRC take longer than ORC but are associated with significantly less blood loss and quicker recovery. Hospital stay is shortest for RRC, which also has the lowest complication rate. The minimally invasive approaches do not appear to compromise cancer control, at least in the medium term.
ABSTRACTS – Session 2

ABSTRACT 209

IS ROBOTIC SURGERY TRULY ERGONOMIC FOR THE SURGEON?

Oussama Elhage¹, Ben Challacombe¹, Declan Murphy¹, Adam Shortland², Prokar Dasgupta¹

¹Department of Urology, Guy’s and St Thomas’ Hospitals NHS Foundation Trust and King’s College London School of Medicine, London, UK
²Small Step Gait Laboratory, Guy’s Hospital, London, UK

Introduction: Considerable controversy surrounds the benefits or otherwise of robotics in urology. Sceptics believe it to be just another expensive tool with little evidence to suggest that it is superior to laparoscopy. One of the possible advantages of robotic surgery is improved ergonomics and reduction in the fatigue felt by the surgeon. We are studying the effects of standard surgical tasks performed using the robotic-, laparoscopic- and open- techniques on muscular fatigue, perceived fatigue and body posture and movement. Here, we present initial data from our da Vinci robot in our Gait Lab.

Methods: Standard simulations of endoscopic validated surgical tasks were conducted using the da Vinci robot. Multiple high definition cameras tracked the motion of the surgeon seated at the console. Motion sensors and EMG electrodes were attached to the torso, arms and a head band. Surface EMG signals were recorded from the upper trapezius and brachioradialis for a period of 7.5 seconds at a sampling frequency of 1080 Hz every minute. Five minute test of each of the five tasks (Rope passing, paper cut, needle capping, knot tying and needle threading) was carried out. The signals were high pass filtered (20 Hz) and the Power Spectral Density of the signals computed. The median frequencies of the signals were calculated.

Results: We found no significant differences between the median frequencies computed over the course of each task (simulation) for all the tasks conducted.

Discussion: Our experiments did not show significant difference in muscle activity when using the robot. This indicates that either the robot actually reduces the level of surgical fatigue or that the surgical tests used here were not sufficient to induce fatigue in the selected musculature.
LAPAROSCOPIC NEPHRECTOMY FOR REFRACTORY HYPERTENSION

Oussama Elhage, Ravi Mallina, Ben Challacombe, Declan Murphy, Arun Sahai, John Scoble, Prokar Dasgupta

Department of Urology and Nephrology, Guy's and St Thomas' Hospitals NHS Foundation Trust and King's College London School of medicine, London, UK

Introduction: Secondary hypertension can be caused by a number of nephrological and urological conditions. Nephrectomy may be indicated for the treatment of benign renal hypertension in a minority of cases. Here we review our experience.

Methods: A total of 12 patients (7 females, 5 males) underwent laparoscopic (retroperitoneal) nephrectomy to treat hypertension and nonfunctioning kidneys. Pre-and post-operative creatinine, blood pressure (BP), and antihypertensive medications were recorded. Patients initially had renal vein renin measured but this was subsequently found not to be correlative.

Results: The median age was 41 years. There were no conversions to open surgery. Mean estimated blood loss was 75 mls and there were no post operative complications. Length of stay was a median of 2 days and full recovery was 3 (1-6) weeks. Histology confirmed 8 giant hydronephrotic, one nephrosclerotic and 3 atrophic kidneys. All patients had normal pre- and post-operative creatinine. Preoperative systolic BP was 155 mmHg (140-190) and diastolic was 90 (85-105). Eight patients had a complete response (66%), with a normal BP within 1-7 days. Three patients still needed antihypertensives in smaller doses, representing a partial response (25%). One patient continues to have an uncontrolled BP, representing no response (8.3%).

Conclusion: Laparoscopic nephrectomy is a minimally morbid and effective treatment of hypertension due to a poorly functioning kidney in some refractory cases.
ABSTRACT 211

DEVELOPMENT OF AN IN VIVO CHRONIC TUMOUR-MIMIC MODEL IN UROLOGY

Rodrigo Frota, Georges-Pascal Haber, Osamu Ukimura, Kazumi Kamoi, Jose Roberto Colombo Jr, Yi-Chia Lin, Monish Aron, Erick Remer, Charles O’Malley Jr., Jihad Kaouk, Inderbir Gill.

Introduction: An acute tumour mimic model for the learning of radiofrequency in liver and kidney was previously reported. We report herein a novel chronic renal and prostate in vivo tumour-mimic model that is hyperechoic on ultrasound and hyperdense on CT scan.

Methods: The formulation is a variation of the agarose-based tissue mimic model: 6g of agarose, 12 g of natural fiber, 3 g of iron sand, 14 ml of glycerol, 3cc of contrast media (76%), 2 cc methylene blue (USP 1%), and 40 cc of sterile water. The mixture is heated to just under its boiling point in a microwave oven and then cooled to 60˚ C before being injected slowly through a 20 G needle. This mixture has been injected percutaneously into porcine kidneys and transrectally into dog prostates.

Results: The mixture returns to a gel consistency at 40˚ C, the created lesions are ovale, intraparenchymal and/or subcapsular. When injecting 1cc of the mixture, the lesion created is 1.5*1 cm at day 0, 2.7*1cm at day 2, 2.5*1cm at day 15 and day 30. The lesion is hyperdense on CT scan and chronically hyperechoic on ultrasound. The cost of the all components is less than US$ 250 and allows us to make more than 500 lesions.

Conclusion: This new model is very attractive. It allows the creation of large tumours, which are hyperdense on CT scan and chronically hyperechoic on ultrasound.
KTP LASER ROBOTIC NERVE-SPARING RADICAL PROSTATECTOMY:
DEVELOPMENT AND INITIAL CLINICAL EXPERIENCE

Troy Gianduzzo, Jihad Kaouk, Jose R Colombo Jr., Georges-Pascal Haber,
Cristina Magi-Galluzzi, Jason Hafron, Monish Aron, Inderbir S Gill

Glickman Urological Institute, Cleveland Clinic Foundation, Cleveland, Ohio, USA

Introduction: Diathermy and ultrasonic shears used in laparoscopic and robotic prostatectomy are known to affect cavernous nerve function while athermal techniques rely heavily on the assistant for optimal dissection and accurate clip placement. The 532nm KTP laser is selectively absorbed by hemoglobin and potentially allows fine dissection with good hemostasis and minimal tissue injury.

Methods: Study 1: The neurovascular bundle (NVB) anatomy and physiology was examined in 12 dogs to confirm the suitability of the dog as a radical prostatectomy model. Study 2: Laparoscopic unilateral NVB mobilization was performed in 36 dogs using either: (1) KTP laser (n=12) using a 200 µm Endostat® fiber at 6W, (2) ultrasonic shears (US) (n=12), or (3) clips and cold scissors (C&S) (n=12). The peak intracavernosal pressure response to nerve stimulation was recorded as a percentage of mean arterial pressure (ICP%MAP) both immediately following NVB mobilization and after 1 month survival. Thermographic analysis was performed on strips of peritoneum and prostate specimens.

Study 3: KTP laser robotic nerve-sparing radical prostatectomy (RNSRP) was performed in 10 dogs using the da Vinci S system and a purpose-built robotic laser delivery instrument through which a 300µm Endostat® fiber was passed to deliver KTP laser energy at 2-6W. Study 4: Following IRB approval, KTP laser RNSRP was performed clinically in 10 patients using the AuraXP laser unit delivering 12W through a 300µm Endostat® fiber.

Results: Study 1: The canine NVBs were confirmed to course along the postero-lateral aspect of the prostate and generate a mean (range) ICP%MAP of 94 (76-113) % with cavernous nerve stimulation. Study 2: The ICP% MAP following unilateral NVB mobilization was similar acutely and at 1 month for the KTP and C&S groups but was significantly decreased for the US group. Acute laser necrosis was 0.5-1.0mm with focal areas up to 2mm in some sections. Thermal spread >60°C from the KTP laser was significantly less than US (KTP 0.98 mm vs. US 6.25 mm, p<0.0001).

<table>
<thead>
<tr>
<th>Mean ICP%MAP</th>
<th>KTP</th>
<th>C&amp;S</th>
<th>US</th>
<th>KTP vs. C&amp;S</th>
<th>US vs. KTP</th>
<th>US vs. C&amp;S</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute post dissection</td>
<td>92%</td>
<td>96%</td>
<td>49%</td>
<td>p=0.54</td>
<td>p&lt;0.001</td>
<td>p&lt;0.001</td>
</tr>
<tr>
<td>Chronic 1 month</td>
<td>95%</td>
<td>98%</td>
<td>58%</td>
<td>p=0.71</td>
<td>p=0.02</td>
<td>p=0.02</td>
</tr>
</tbody>
</table>

Study 3: All 10 procedures were performed solely with laser energy. Mean pre and post dissection ICP%MAP were not significantly different (pre 99.3%, post 83.7%, p=0.2). Study 4: All 10 procedures were successfully completed. Additional hemostasis using diathermy, suture or clips was required on an average of 8 occasions per case. The mean follow-up of 7 weeks is too short for meaningful potency evaluation at this time. Three-month SHIM scores are pending. There was 1 urine leak and 1 drain site infection. Eight patients had pT2 disease and 2 had pT3. All surgical margins were negative. The mean perioperative values were:

<table>
<thead>
<tr>
<th>OT time</th>
<th>blood loss</th>
<th>haemoglobin decrease</th>
<th>hematocrit decrease</th>
<th>prostate weight</th>
<th>hospital stay</th>
<th>laser time</th>
<th>laser energy</th>
</tr>
</thead>
<tbody>
<tr>
<td>217 min</td>
<td>290 ml</td>
<td>2.2 g/dl</td>
<td>6.83%</td>
<td>63.2 g</td>
<td>39.9 hrs</td>
<td>65.9 min</td>
<td>20862 J</td>
</tr>
</tbody>
</table>

Conclusion: KTP laser RNSRP did not significantly affect cavernous nerve function in the canine model and was feasible and safe in the clinical human setting. Hemostasis requires refinement and long-term assessment of potency outcomes are needed to determine the value of this technique.
ABSTRACT 213

KTP LASER ROBOTIC PARTIAL NEPHRECTOMY WITHOUT HILAR CLAMPING: DEVELOPMENT AND INITIAL CLINICAL EXPERIENCE

Troy Gianduzzo, Alireza Moinzadeh, Georges-Pascal Haber, Jose Roberto Colombo Jr., Mike Nguyen, Monish Aron, Mihir Desai, James Ulchaker, Jihad Kaouk, Inderbir S Gill.
Glickman Urological Institute, Cleveland Clinic Foundation, Cleveland, Ohio, USA

Introduction: Laparoscopic partial nephrectomy (LPN) is technically demanding requiring advanced laparoscopic skills. Hilar clamping is essential, however the associated time constraints add to the complexity of tumor excision and parenchymal reconstruction. The 532nm KTP laser is selectively absorbed by hemoglobin and has improved hemostasis which may allow excision of the mass without hilar clamping, thus optimizing renal preservation and technically simplify the procedure.

Methods: Animal Study. Six Jersey calves underwent 12 staged bilateral transperitoneal laser LPNs using an 80W KTP laser, including left kidney chronic LPN with 1-month follow-up in 6 and right kidney acute LPN with immediate sacrifice in 6. Two techniques (ablative vaporization 5 subjects and wedge resection in 7) were evaluated. Renal parenchymal resection and hemostasis were achieved only with the laser without any adjunctive hemostatic sutures or bio-adhesives. Retrograde pyelography, renal arteriography and histological analyses were performed.

Instrument Development. A purpose-built, prototype robotic laser delivery instrument was subsequently developed to accommodate a 400µm custom-made end-firing laser fiber and tested.

Initial Clinical Experience. KTP laser robotic partial nephrectomy without hilar clamping was trialed in 2 patients to date with IRB approval. KTP laser robotic partial nephrectomy was performed in each patient using the Greenlight HPS® laser unit at settings up to 50W.

Results: Animal Study. Eleven of the calf procedures were performed without hilar clamping. Mean total operative time was 2.9 hours and mean blood loss was 119ml. Mean lasing time was 56 minutes with an average energy use of 54 kJ. Mean preoperative and postoperative hemoglobin (10.38 and 10.52 g/dl) were similar. At 1-month follow-up there was no evidence of urinary leak or AV fistula.

Initial Clinical Experience. The first clinical case involved a 2.5cm upper pole mass abutting the renal sinus. Ninety percent of the excision was completed without hilar clamping. A large, central segmental vessel was encountered necessitating hilar clamping and Weck® clip application. The second procedure was performed completely without hilar clamping. One central vessel required intraoperative suturing. There were no complications in either case and the depth of thermal injury was approximately 1mm.

<table>
<thead>
<tr>
<th>Case</th>
<th>Mass Size</th>
<th>Mass Excision Time</th>
<th>Laser Activation Time</th>
<th>Laser Energy</th>
<th>Blood Loss</th>
<th>Warm Ischemia Time</th>
<th>Margins</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2.5 cm</td>
<td>36 min</td>
<td>13:43 min</td>
<td>30,748 J</td>
<td>200 ml</td>
<td>11 min</td>
<td>Neg</td>
</tr>
<tr>
<td>2</td>
<td>1.5 cm</td>
<td>37 min</td>
<td>17:07 min</td>
<td>48,819 J</td>
<td>300 ml</td>
<td>None</td>
<td>Neg</td>
</tr>
</tbody>
</table>

Conclusion: To our knowledge this is the first report of KTP laser robotic partial nephrectomy without hilar clamping in the clinical setting. Further clinical procedures are planned to continue to evaluate the utility of this technique.
ABSTRACTS – Session 2
ABSTRACT 214

SURGEON’S PERCEPTIONS AND INJURIES DURING AND AFTER UROLOGIC LAPAROSCOPIC SURGERY

Ofer N. Gofrit, Albert A. Mikhail, Kevin C. Zorn, Gregory P. Zagaja, Gary D. Steinberg and Arieh L. Shalhav

Department of Surgery, Section of Urology, University of Chicago, Chicago, Illinois

Objectives. The biomechanical and mental strains placed on the surgeon while performing laparoscopic procedures are significantly higher compared to open surgical techniques. We undertook this study to assess the prevalence of surgeons' deleterious perceptions or injuries related to laparoscopic urologic surgery.

Methods. Members of The Endourological Society were mailed a questionnaire evaluating their laparoscopic experience, in terms of the total number of standard laparoscopic surgeries (SLS), hand-assisted laparoscopic surgeries (HALS) and robotic-assisted laparoscopic surgeries (RALS) they have performed. The subjects reported on any neuromuscular or arthritic injuries sustained during laparoscopic surgery, and graded the degree of pain, numbness and fatigue that they experienced.

Results. Seventy-three urologists completed the questionnaires. The “average responder” was 44-year-old, had completed a median of 117 procedures, and was performing 3 laparoscopic surgeries per week. Neuromuscular or arthritic symptoms during surgery were reported by 22 responders (30%), the most common was finger paresthesia (18%). At the conclusion of HALS, 45% of the surgeons suffered from hand and wrist numbness and 37% reported pain in these areas. A significant association was observed between the risk of sustaining injury during surgery and the total number of laparoscopic procedures performed by the responder (p=0.016). RALS was the procedure least associated with injuries and HALS the most.

Conclusions. The laparoscopic operating theater is a hostile ergonomic environment. Surgeon’s awareness to the common injuries associated with laparoscopic surgery and careful equipment adjustments before surgery are mandatory in order to minimize injury. Future improvements in instrument design according to ergonomic principles are highly warranted.
ABSTRACT 215

AMBULATORY DEVICE FOR RECORDING UROLOGICAL RESPONSE TO INTENSE PHYSICAL ACTIVITY OF ELITE NULLIPAROUS FEMALE ATHLETES

Mithun M. Gundi¹, Prashanth Balasubramanian², Gerald W. Timm³, Arthur G. Erdman², Ahmed H. Tewfik¹
¹Department of Electrical Engineering, ²Department of Mechanical Engineering, ³Department of Urological Surgery; University of Minnesota, Minneapolis, MN 55455

Introduction: Urinary incontinence historically has been a concern for parous and elderly women. However previous studies have shown a high prevalence of urinary incontinence in young, physically fit female athletes. Yet, there is no clear understanding of the mechanisms that cause urinary incontinence to occur. To advance our understanding of this problem, we are developing an ambulatory device for recording urological response to intense physical activity of elite nulliparous female athletes.

Materials and Methods: The device (shown right) includes an active surface electrode, a triaxial accelerometer, a triaxial inclinometer and a urinary leakage detector (ULD). The active surface electrode records the electromyographic (EMG) signals of the pelvic floor muscles. The accelerometer and inclinometer, together with the ULD, enable us to determine the intensity of physical activity at which urinary leakage occurs. The device is small, lightweight and battery powered, and can be worn comfortabily by female athletes. All recordings are taken noninvasively and transmitted wirelessly to a receiver connected to a PC where further real-time and off-line processing is carried out.

Results: Sample accelerometer readings (shown below) obtained for a female athlete indicate the high ‘g’ values (up to 8.5 g) experienced during a simple physical activity involving jumps from varying heights. Detailed analysis of such graphs enables us to determine the appropriate sampling rate for various physical activities as well as the time interval within which to expect the surface electromyographic (SEMG) activity.

Conclusion: The ambulatory device will enable us to determine if urinary incontinence in elite nulliparous female athletes occurs during vigorous physical activities or as a result of the fatigue caused by these activities. It can be used to understand the pathophysiology of urinary incontinence. Additionally, it can be used to develop appropriate training protocols that would reduce the occurrence of incontinence while participating in athletics.
PERCUTANEOUS CRYOABLATION OF KIDNEY LESIONS UNDER COMBINED REAL-TIME ULTRASOUND AND 3D CT SCAN NAVIGATION
Georges-Pascal Haber, Osamu Ukimura, Jose R Colombo Jr, Yi-Chia Lin, Philippe Koenig, Troy Gianduzzo, Monish Aron, Cristina Magi-Galluzzi, Inderbir S Gill, Jihad H Kaouk
Cleveland Clinic, Cleveland, USA

Introduction: Accuracy of percutaneous cryoablation for kidney tumors performed under combined real-time ultrasound and 3D CT scan navigation in a porcine model.

Method: Eleven pigs were divided into an acute group (n=3) and a chronic group (n=8). After injecting 2 tumor mimic lesions in each kidney, a CT scan was performed and digital data was saved in a novel navigation system (RVS®) that allows synchronization with real-time ultrasound images. The cryoprobe was guided percutaneously into the tumor mimic and the ice ball formation monitored continuously using the RVS® navigation system. Kidneys were sent for macroscopic and histopathologic analysis at day 0 in the acute group, day 15 and day 30 in the chronic group.

Result: Thirty-five renal tumor mimic were treated by percutaneous cryotherapy; tumors locations were: 16 tumors (46%) in the lower pole, 14 (40%) middle pole, and 5 (14%) in the upper pole. Eleven tumors (31%) were intraparenchymal and 24 (69%) subcapsular. The synchronization between the CT scan image reconstruction and real-time ultrasound was successful in all cases. The mean (range) tumor size was 2 cm (1.2 - 4). Mean cryo-necrosis size was 3.3 cm, 3.7 cm, and 2.8 cm at day 0, day 15, and day 30, respectively. Three (8.5%) positive margins were found on the macroscopic and microscopic analysis.

Conclusion: This novel RVS® imaging system synchronizing real-time ultrasound with preoperative CT scan enhance accuracy of probe ablation techniques for kidney tumors. Clinical application is imminent.
ENDOLUMINAL REAL-TIME ULTRASOUND MONITORING FROM RENAL PELVIS FOR MINIMALLY INVASIVE NEPHRON-SPARING SURGERY

Kazumi Kamoi1, Inderbir S. Gill1, Jihad Kaouk1, Georges-Pascal Haber1, Yi-Chia Lin1, Tsuneharu Miki2, and Osamu Ukimura2

1Section of Laparoscopic and Robotic Surgery, Glickman Urological Institute, Cleveland Clinic Foundation, Cleveland, OH
2Department of Urology, Kyoto Prefectural University of Medicine, Kyoto, Japan

Introduction: Real time monitoring of tumors extending close to the collecting system or renal hilum remains challenge, during minimally invasive nephron sparing surgery (NSS). We hypothesize that trans-renal-pelvic endoluminal ultrasound (US) has the potential to provide detailed real-time visualization of treatment margins close to the collecting system. Aim of this study is to evaluate feasibility of endoluminal US through the renal pelvis.

Methods: A small diameter (2 mm), 12-20 MHz wavelength endoluminal ultrasound probe was inserted in the renal pelvis retrogradely. This preliminary study was performed on 9 kidneys, including 8 ex vivo human kidneys with renal cell carcinoma, and one in vivo porcine kidney, with tumor mimic models, treated by percutaneous cryotherapy and LPN.

Results: Endoluminal US, inserted retrogradely, visualized detail anatomy of renal collecting system and tumor, and allowed to measure the tumor size and distance between tumor margin and collecting system as well as renal hilum. Endoluminal ultrasound provided real-time images to place cryoprobe and to monitor ice ball formation and extension during cryoablation. Laparoscopic scissors tip was also visualized while performing LPN.

Conclusion: High-frequency trans-renal-pelvic endoluminal US was feasible to demonstrate renal tumor and surgical procedure. This has the potential to provide real-time visualization of treatment margins close to the collecting system and renal hilum, especially for central or hilar renal tumor during minimally invasive nephron-sparing surgery.
ABSTRACT 218
EVALUATION OF A NOVEL CORDLESS PNEUMATIC LITHOTRIPTER

Christopher C. Kyle\textsuperscript{1}, Abhay Rane\textsuperscript{2}, Vishal K. Bhalani\textsuperscript{1}, Robert I. Carey\textsuperscript{1}, Raymond J. Leveillee\textsuperscript{1}
\textsuperscript{1}University of Miami Department of Urology, Miami, Florida USA
\textsuperscript{2}East Surrey Hospital, Redhill, England

Introduction and objectives. Pneumatic lithotripsy is an effective technique for intracorporeal lithotripsy. The StoneBreaker™ (LMA Urology Suisse, Switzerland) is a new handheld cordless pneumatic lithotripter designed for endourologic applications. It is powered by a pressurized CO\textsubscript{2} cartridge. There is little data describing the safety of the device or comparing it to other pneumatic lithotripters. First, we evaluated the ability of the StoneBreaker™ to perforate a ureter in an \textit{ex vivo} setup. Second, we compared the fragmentation efficiency of the StoneBreaker™ to the Swiss Lithoclast™ (Boston Scientific, Boston) in an \textit{ex vivo} model.

Methods. For the perforation model, a freshly harvested porcine ureter was ligated at its distal end. The proximal end was introduced over a 6.9 French semi-rigid ureteroscope (Circon ACMI, Santa Barbara, California). A mixture of methylene blue and normal saline were infused through the irrigation port from a height of 90cm to maintain a constant intraluminal pressure of 90cm H\textsubscript{2}O. The ureteroscope and ureter were affixed to an underwater apparatus and the angle of incidence was manipulated such that the working channel was directly opposite the ureteral wall. The pneumatic probe was advanced under vision to the wall and fired 100 times. Under similar conditions, a holmium laser perforates the wall with fewer than 20 pulses (visible as a jet of blue irrigant). To compare fragmentation efficiency, the number of hits required to break 10 large, 10 medium, and 10 small Ultracal-30 stone phantoms to fragments smaller than 7mm (large and medium) or 3 mm (small) was recorded for both the Stonebreaker™ and the Swiss Lithoclast™. These sizes were chosen to reflect pelvic, calyceal, and ureteral stones, respectively. Student’s \textit{t}-test was used to compare the results.

Results. The StoneBreaker™ did not perforate the ureteral wall, even after more than one hundred fires. For large stone phantoms (mean 7.4 gms), the Lithoclast™ required an average of 307 fires, as compared to 77 for the StoneBreaker™ (\textit{p}<0.001). For medium stones, (mean 3.2gms), the Lithoclast™ needed an average of 221 fires, as compared to 46 for the StoneBreaker™ (\textit{p}<0.001). Small stones (mean 0.50 grams), required an average of 72 hits for the Lithoclast™ as compared to 26 for the StoneBreaker™ (\textit{p}<0.01).

Conclusions. In an \textit{ex vivo} model, the StoneBreaker™ does not perforate the ureter, even after multiple direct hits. The StoneBreaker™ is more efficient than the Swiss Lithoclast™ at fragmentation of stone phantoms \textit{ex vivo}.
ABSTRACTS – Session 2

ABSTRACT 219

PERSPECTIVES IN THREE DIMENSIONAL (3D) ASSISTING FOR ROBOTIC LAPAROSCOPIC PROSTATECTOMY

Vincent J. Lanteri 1,2, Michael P. Esposito 1,2, Mutahar Ahmed 1,2

1 Department of Urology, Hackensack University Medical Center, Hackensack, New Jersey
2 Division of Urology, Department of Surgery, University of Medicine and Dentistry of New Jersey, New Jersey Medical School, Newark, New Jersey

During the last five years, the da Vinci Robot has increasingly been used in performing the radical prostatectomy. One of the benefits of the robot is the surgeon’s ability to perform the operation in three dimensions (3D). A concurrent realization has been the limitations placed on the assistant surgeon who is viewing the procedure and simultaneously assisting in two dimensions (2D).

Recent technological advances such as the Viking Digital Vision system is now permitting the assisting surgeon the same benefit of three dimensions in synchronization with the robotic surgeon. Da Vinci robotic technology has revolutionized prostate cancer surgery and is gaining momentum. Within the foreseeable future robotic surgery for this disease may become the standard.

As the procedure has evolved in the treatment of prostate cancer surgeons rely on technical innovations to refine their technique and improve outcomes. Since the inception of robotic surgery the role of the assistant has been compromised by the limitations of their two dimensional (2D) flat visual field. The introduction of the Viking Systems Endosite Digital Vision System has resolved the dilemma by allowing the assistant access to three dimensional (3D) viewing and assisting of the procedure. The depth and dimension provided by a three dimensional (3D) view enables optimal hand eye coordination while minimizing eye strain. Visual accuracy and optical immersion make the endoscopic surgical field-of-view appear open. The comfortable head-mounted display (HMD) provides the ultimate in clarity, flexibility and ergonomic design, and allows the assistant to focus on the surgical field, and reduces the fatigue associated with turning or moving to view a standard monitor.

Since 2002, 850 da Vinci robotic prostatectomies were performed at Hackensack University Medical Center, with the surgical assistant using the two dimensional field. Most recently, 25 consecutives procedures were performed with the assistant surgeon using the Viking Endosite System. The ability of the assisting surgeon to anticipate the robotic surgeons needs were enhanced with his three dimensional field (3D). Specific examples include:

1. Retraction while bladder is dropped;
2. Opening of the endopelvic fascia;
3. Coordination with ligation of the dorsal venous complex (DVC);
4. Tapering and transaction of the bladder neck;
5. Dissection of the vas deferentia and seminal vesicles;
6. Athermal bilateral nerve sparing;
7. Transection of the DVC and urethra;
8. Aid in the urethrovesical anastomosis; and
9. Retraction during the bilateral lymph node dissection.

Additional benefits include hands on training of board certified urologists, fellows and residents, allowing them to view the three dimensional (3D) surgical field and promoting interactive learning experiences during the procedure.

Having both Intuitive Surgical’s da Vinci system and Viking System’s Endosite Digital Vision system is the ultimate combination and allows the surgeon and the assistant to finally operate on the same surgical field. Additionally, the advantage of both systems may translate into improved operative times, shortened learning curves, and greater surgeon-assistant comfort. This might allow the beginning robotic surgeons and assistants to become experts quicker and without limitations.
ABSTRACTS – Session 2

ABSTRACT 220

ARTICULATED NEEDLE DRIVERS WITH 3-D VISION: A COMPARISON WITH CONVENTIONAL NEEDLE DRIVERS AND SURGICAL ROBOT

Yi-Chia Lin*, Georges-Pascal Haber, Philippe Koenig, Bruno M R Santos, Troy Gianduzzo, Rodrigo Frota, Kazumi Kamoi, Burak Turna, Inderbir S Gill and Jihad H Kaouk

Cleveland Clinic Foundation, Cleveland, Ohio

Introduction: Limited range of freedom using straight conventional needle drivers (CND) and two-dimensional (2-D) vision are major obstacles for laparoscopic free-hand suturing. A novel articulated needle driver (AND) (Radius Surgical System, Tuebingen Scientific, Germany) with 6 degrees of freedom and a three-dimensional (3-D) vision generator (Viking Systems, San Diego, CA) were evaluated in combination and compared with CND and surgical robot.

Methods: Following 20 min of practice with each instrument, 2 specific tasks were performed in a pelvic trainer by 15 urologists divided into 3 groups (expert (n=5), intermediate (n=5) and novice (n=5)) according to their laparoscopic experience. The first task included 1 sagittal, 1 coronal and 1 oblique running suture with knot tying in the horizontal plane. The second test consisted of a running urethra-vesical anastomosis in a rubber model. Total time for each line of suturing, time for knot tying, time to accomplish urethra-vesical anastomosis, precision and accuracy were compared.

Results

<table>
<thead>
<tr>
<th></th>
<th>CND</th>
<th>AND</th>
<th>AND + 3-D vision</th>
<th>Surgical robot</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expert</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Knot tying (sec)</td>
<td>42.5 ± 9.7</td>
<td>120.5 ± 20.8*</td>
<td>110.4 ± 21.8*</td>
<td>40.2 ± 8.7*†#</td>
</tr>
<tr>
<td>Suturing time(min)</td>
<td>7.4 ± 3.8</td>
<td>9.0 ± 3.6</td>
<td>8.1± 5.2</td>
<td>5.1 ± 1.5*†#</td>
</tr>
<tr>
<td>Anastomosis (min)</td>
<td>25.6 ± 10.8</td>
<td>40.1 ± 16.8*</td>
<td>36.5 ± 12.5*</td>
<td>17.3 ± 6.5*†#</td>
</tr>
<tr>
<td>Precision (%)</td>
<td>81.3 ± 7.6</td>
<td>88.4 ± 6.2*</td>
<td>86.5 ± 7.5*</td>
<td>94.4 ± 6.5*†#</td>
</tr>
<tr>
<td>Accuracy (%)</td>
<td>69.7 ± 5.3</td>
<td>85.8 ± 6.3*</td>
<td>86.0 ± 5.4*</td>
<td>95.4 ± 6.6*†#</td>
</tr>
<tr>
<td>Intermediate</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Knot tying (sec)</td>
<td>59.5 ± 10.8</td>
<td>113 ± 22.6*</td>
<td>76.5 ± 24.5*†#</td>
<td>103.6 ± 43.2*†#</td>
</tr>
<tr>
<td>Suturing time(min)</td>
<td>9.7 ± 4.1</td>
<td>10.0 ± 4.0</td>
<td>7.5 ± 3.6*†</td>
<td>8.0 ± 1.1*†#</td>
</tr>
<tr>
<td>Anastomosis (min)</td>
<td>23.8 ± 14.5</td>
<td>32.5 ± 16.8*</td>
<td>28.5 ± 10.5</td>
<td>26.9 ± 4.3*†</td>
</tr>
<tr>
<td>Precision (%)</td>
<td>70.9 ± 16.3</td>
<td>88.6 ± 8.8*</td>
<td>89.5 ± 10.6*</td>
<td>88.2 ± 7.9*</td>
</tr>
<tr>
<td>Accuracy (%)</td>
<td>59.4 ± 12.6</td>
<td>81.3 ± 16.5*</td>
<td>84.6 ± 17.5*</td>
<td>80.4 ± 12.2*</td>
</tr>
<tr>
<td>Novice</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Knot tying (sec)</td>
<td>117.6 ± 18.5</td>
<td>173.0 ± 34.5*</td>
<td>158.8 ± 45.5*</td>
<td>184.6 ± 50.0*†#</td>
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<tr>
<td>Suturing time(min)</td>
<td>12.1 ± 6.5</td>
<td>13.8 ± 3.2</td>
<td>14.8 ± 4.6</td>
<td>11.4 ± 1.1</td>
</tr>
<tr>
<td>Anastomosis (min)</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>31.7 ± 3.5</td>
</tr>
<tr>
<td>Precision (%)</td>
<td>55.6 ± 16.8</td>
<td>85.6 ± 9.5*</td>
<td>88.6 ± 12.8*</td>
<td>71.8 ± 18.6*</td>
</tr>
<tr>
<td>Accuracy (%)</td>
<td>54.3 ± 7.6</td>
<td>77.3 ± 19.5*</td>
<td>78.6 ± 10.6*</td>
<td>75.6 ± 12.6*</td>
</tr>
</tbody>
</table>

All data are presented as Mean ± Standard deviation
*; p<0.05, comparing to CND; †; p<0.05, comparing to AND; ‡; p<0.05, comparing to AND + 3-D vision
na: data not available due to incomplete task

Conclusion: Precision and accuracy was significantly improved in all groups with AND, AND plus 3-D vision and robot compared to CND. 3-D vision especially reduced the time to accomplish the tasks in intermediate group. Robot specifically enhanced the performance in expert group compared to AND + 3D vision. Combination of AND and 3-D vision showed benefits in intermediate and novice groups.
ABSTRACT 221

EASE OF PLACEMENT AND REMOVAL OF LOOP TAIL STENTS VS. STANDARD PIGTAIL STENTS

James E. Lingeman, M.D., Methodist Hospital Institute for Kidney Stone Disease, Indianapolis, Indiana; Glenn M. Preminger, M.D., Duke University Medical Center, Durham, North Carolina

Introduction and Objective: Ureteral stents are commonly used to maintain urinary drainage and are typically removed by flexible cystoscopy in an office setting with little or no sedation. Although usually completed quickly, the procedure can be painful for patients, especially males. Common double pigtail stents can create challenges for the physician to grasp and remove.

Currently available, newly designed Short Loop Tail (SLT) and Long Loop Tail (LLT) stents substitute distal 6 Fr pigtail ends with ≤ 3 Fr loops (Figure 1). A prospective, randomized, 4 arm, multicenter study was conducted to compare SLT and LLT stents vs. marketed controls (Polaris™, Percuflex Plus®), with the hypothesis that the loop design would improve ease of placement and removal.

Methods: 236 adults requiring retrograde unilateral ureteral stent placement for 4 – 28 days were randomized (1:1:1:1 ratio): SLT (n=60), LLT (n=59), Percuflex Plus (n=64); Polaris (n=53). Investigators assessed the ease of stent placement and removal via questionnaire. Differences in mean scores and pairwise differences between mean scores were tested at $\alpha=0.05$.

Results: Differences in removal mean scores were statistically significant, favoring SLT in Overall Ease ($p=0.0032$) and for Grasping Ease ($p=0.0002$). Pairwise comparisons favored SLT and LLT clinically and statistically. An interesting method for SLT/LLT removal involved a suture tied through the loops to facilitate grasping. For nearly all placement measures, mean scores were clinically similar and not statistically different between stents; mean scores for Fluoro/X-Ray Visualization favored SLT ($p=0.0459$). Many device-related adverse events (AEs) were expected side effects of ureteral stents. The 5 most common related AEs (in > 15% patients, overall) were flank pain, hematuria, dysuria, frequent urination, and urinary urgency. All other related AEs were reported for ≤4 patients per stent group. Most related AEs (86.5%) were judged by the investigators as mild or moderate in severity. Unrelated stent migration was reported for 1 patient (SLT).

Conclusion: Ease of Loop Tail Stent removal was clinically and statistically superior to standard pigtail stents, with the SLT showing the best results.
ABSTRACT 222

BLADDER SMOOTH MUSCLE CELL RESPONSES TO CONTACT GUIDANCE
AND CYCLIC MECHANICAL STRETCH

Rebecca A. Long¹, Aron Parekh¹, Michael B. Chancellor², and Michael S. Sacks¹
¹Department of Bioengineering, University of Pittsburgh, Pittsburgh, PA
²Department of Urology, University of Pittsburgh, Pittsburgh, PA

Introduction: A major limiting factor in tissue engineering the urinary bladder wall is the lack of proper tissue organization following bladder augmentation surgery. Proper tissue structure is essential to ensure bladder functionality. The present study was thus undertaken to develop approaches that promote increased tissue organization and function prior to implantation.

Methods: Poly(dimethyl)siloxane (PDMS) microgrooves were fabricated using soft photolithography. Bladder smooth muscle cells (BSMC) isolated from rat bladders were seeded 100,000 cells/cm² onto the patterned PDMS. BSMC were mounted in a tension or biaxial stretch bioreactor to be stretched in culture up to 10 days. Scanning electron microscopy (SEM) was performed, and F-actin staining (Molecular Probes) was used to visualize cell alignment. Sircol Collagen and Fastin Elastin assays (UK Biocolor) were utilized to measure extracellular matrix (ECM) production.

Results: Microgrooved PDMS was able to be fabricated with uniform grooves of varying dimensions. These grooves provided contact guidance for the bladder SMCs and promoted alignment. Narrower grooves led to qualitatively higher alignment of bladder SMCs. On flat surfaces, BSMC aligned perpendicular to the direction of uniaxial stretch (Fig 1A). Under equi-biaxial stretch and static culture, F-actin staining of BSMC showed little to no alignment (Fig 1B,C). After 10 days in culture, uniaxial stretch down-regulates elastin production and up-regulates collagen production. In preliminary studies, samples under equi-biaxial stretch performed in our biaxial stretch bioreactor had increased elastin and collagen production compared to uniaxial stretching. These results may be caused by a switch from a contractile to a synthetic cell phenotype under biaxial mechanical stretch. The phenotype of the cells will be confirmed in future studies.

Conclusion: The use of PDMS microgrooves provided necessary contact guidance for the bladder SMC organization, and biaxial stretch promoted more ECM production than uniaxial stretch. This study suggests that contact guidance and mechanical stretch can be used to manipulate BSMC alignment and ECM production, which may lead toward engineering more organized, functional bladder tissue replacements.
OPTIMAL PNEUMATIC SETTING FOR THE LITHOCLAST ULTRA® IN A CYSTOLITHOLAPAXY MODEL

Michael K. Louie, Bodo E. Knudsen

The Ohio State University Medical Center

Introduction: The Lithoclast Ultra® is a combined ultrasonic and pneumatic lithotrite recently shown to increase the efficiency of the fragmentation and clearance rates of renal calculi. We constructed a cystolitholapaxy model to investigate the optimal pneumatic setting for the Lithoclast Ultra® in a simulated bladder stone environment.

Methods: An *ex vivo* bladder model was constructed. The test stones used were the Bego and U-30. Ten trials of each stone type were performed at each setting. Each trial consisted of an ultrasonic lithotripsy fragmentation alone, and then in combination with the pneumatic lithotripsy at pneumatic settings of 2Hz, 4Hz, 8Hz, and 12 Hz. The ultrasonic lithotrite used alone was the control group. The ultrasound settings were 90% duty and 100% power. The time to fragment test stones to 5mm, and then to clear all stone fragments was recorded. SPSS v.15 was used for statistical analysis.

Results: Mean time to 5mm fragments for Bego stones using ultrasound alone, and with the pneumatic lithotrite at 2Hz, 4Hz, 8Hz, and 12Hz was 21min, 14min, 10min, 13min, and 14min respectively. Mean time to stone clearance for Bego stones using ultrasound only, 2Hz, 4Hz, 8Hz, and 12Hz was 29min, 25min, 23min, 22min, and 22min respectively. The mean time from 5mm to stone clearance for Bego stones using ultrasound only, 2Hz, 4Hz, 8Hz, and 12Hz was 17min, 16min, 19min, 22min, and 14min respectively. Mean time to 5mm fragments for U-30 stones using ultrasound alone, and with pneumatic lithotrite at 2Hz, 4Hz, 8Hz, and 12Hz was 101s, 89s, 68s, 64s, and 66s respectively. Mean time to stone clearance for U-30 stones using ultrasound only, 2Hz, 4Hz, 8Hz, and 12Hz was 162s, 148s, 133s, 137s, and 127s respectively. Mean time from 5mm to stone clearance for U-30 stones using ultrasound only, 2Hz, 4Hz, 8Hz, and 12Hz was 61s, 60s, 65s, 73s, and 61s respectively.

Conclusion: Our novel cystolitholapaxy model using the Lithoclast Ultra® shows that the combination of pneumatic and ultrasonic lithotrites decreases the time to stone fragmentation and clearance compared to ultrasound alone. The optimal pneumatic frequency appears to reach a plateau at 4Hz.
ARE LASER OPTICAL FIBERS INTERCHANGEABLE WITH DIFFERENT HOLMIUM:YAG LASERS?

Adam Mues¹, Joel M.H. Teichman², Randolph D. Glickman³, Bodo E. Knudsen¹

¹Ohio State University Medical Center, Columbus, USA
²University of British Columbia, Vancouver, Canada
³University of Texas Health Science Center at San Antonio, San Antonio, USA

Introduction: Multiple holmium:YAG lasers are commercially available for the treatment of renal calculi. Utilizing a single holmium:YAG laser, prior studies show holmium:YAG laser fiber performance differs among manufacturers. This study was designed to determine if the risk of failure of 23 commercially available laser fibers differed when tested on 3 different holmium:YAG lasers.

Method: Three holmium:YAG lasers were used for testing: a Lumenis VersaPulse 100W, a NewStar NS1500 12W, and a Dornier Medilas H 20. Twenty three commercially available fibers (150 µm – 365 µm) were evaluated. Fiber durability was assessed by bending the fibers to 180° at a radius of 1.25 cm. The laser was operated at 1.2 J, 10 Hz, for 1 minute or until fiber failure. The bend radius was reduced in 0.25 cm increments and the testing repeated, until a bend radius of 0.5 cm was reached or until fiber failure. The connector end of the fiber was monitored by infrared thermometer. A minimum of 3 trials for each fiber on each laser were run. All testing was done with the fiber submerged in water.

Result: Fiber performance differed on the three lasers. The Dornier Medilas H 20 coupled poorly with non-Dornier fibers. IQinc and BSci Accuflex fibers are incompatible with the Dornier laser with overheating of the connector occurring. Fibers performed similarly on the Lumenis and NewStar lasers, although the threshold for failure is improved slightly on the NewStar laser.

Conclusion: Commercially available laser fibers are not all interchangeable with different holmium:YAG lasers.
ABSTRACT 225


Ravi Munver, M.D., Stuart S. Kesler, M.D., and Ihor S. Sawczuk, M.D.

Hackensack University Medical Center, Hackensack, NJ

Introduction: Robotic-assisted radical prostatectomy is steadily gaining interest throughout the nation. We compared the United States trend for this procedure to the trend at our institution.

Methods: A retrospective review was conducted of radical prostatectomies performed between January, 2001 and December, 2006 at Hackensack University Medical Center. Our medical center has acquired 5 da Vinci™ Surgical Systems: 2 in 2000, 1 in 2002, 1 in 2006, and 1 in 2007. The trends for open and robotic-assisted prostatectomies at our institution, and in the U.S., were analyzed.

Results: Between 2001 and 2006, 1162 radical prostatectomies were performed by 17 urologists: 379 (33%) open radical prostatectomies (ORP) and 783 (67%) robotic-assisted radical prostatectomies (RARP). The urologists performing RARP increased from 3 (18%) in 2001 to 11 (65%) in 2006. The total annual number of radical prostatectomies increased from 2001 (n=125) to 2006 YTD (n=335). The annual proportion of RARPs increased as follows: 9.6%(2001), 28.0%(2002), 40.4%(2003), 72.7% (2004), 96.2% (2005), and 93% (2006). The number of RARPs performed in the U.S. exceeded 200est. (<1%) in 2001, 750est.(<1%) in 2002, 2500est. (3%) in 2003, 8500est. (10%) in 2004, 18,000est. (20%) in 2005, and 31,500est. (35%) in 2006.

Conclusions: The introduction of robotic technology has had a dramatic impact on surgical therapy for localized prostate cancer. When comparing the growth rate of RARP at our institution to that in the U.S., the national rate is lagging by slightly more than 3 years. If the national rate continues to mirror that at our institution, robotic-assisted radical prostatectomy may become the surgical standard for localized prostate cancer in the U.S. as early as 2009.
ABSTRACT 226

ANGIOGRAPHIC FEATURES FOLLOWING PERCUTANEOUS RENAL SURGERY


Purpose: Patients with undergoing complex percutaneous renal surgery (PRS) are at increased risk for delayed renal hemorrhage purported to be a consequence of arterial pseudoaneurysms and arteriovenous fistulas. We describe unique angiographic findings and postulate a cause of delayed presentation for renal hemorrhage.

Materials & Methods: We reviewed our database of 4700 patients undergoing percutaneous renal surgery between August 1983 and November 2006. Angiographic findings and their relative frequency were analyzed. Two patients were identified, one with full staghorn calculi, and another with ureteropelvic junction (UPJ) obstruction who underwent trans-femoral renal angiography concomitant with PRS. In these two patients, the renal artery was identified and pre-PRS angiographic images were obtained. An occluding balloon was inflated in the main renal artery. The kidney was intermittently allowed to perfuse with heparinized saline flushed through the angiographic catheter to prevent clotting. Percutaneous nephrolithotomy was performed and the patient with full staghorn calculi was rendered stone free. Cold-knife endopyelotomy was performed in the patient with UPJ obstruction. Renal angiography was repeated through the established angiographic catheter to identify any vascular injury.

Results: 63 patients had undergone angioembolization for bleeding after PRS. The most common findings on angiography were pseudoaneurysms (59%), arteriovenous fistulas (AVF) (30%), lacerated renal vessel/contrast extravasation (26%), and 2% incidence of blind ending vessel, hyperemia, arterial dissection, and capsular artery hemorrhage, 5% had no demonstrable angiographic findings. In the two patients that had undergone simultaneous PRS and angiography, initial angiography revealed no abnormalities in both patients (figs 1&2). Arterial spasm was noted in sub-segmental branches of the renal artery, but no active bleeding (figs 3&4). These two patients represented with delayed renal hemorrhage post-operatively at 8 and 13 days respectively. Both underwent renal angiography and embolization. A pseudoaneurysm and small sub-segmental arterial bleed were identified, both corresponding to the arterial branches in spasm on post-PRS angiography (figs 5&6).

Conclusion: Arterial spasm is a likely contributor to the etiology of delayed presentation of renal hemorrhage after PRS. Arterial spasm should be suspected in cases of intermittent hemorrhage, especially if no abnormalities are noted on initial angiography.
ABSTRACT 227

IMPACT OF HELPER ORIFICES IN MONOFILAMENT MESHES ON THE TENSILE STRENGTH AT THE INTERFACE: AN IN VIVO STUDY


Introduction and objective: The use of meshes, especially for the anterior vaginal compartment is now well established. However few studies addressed in vivo properties, mainly the tensile strength at the interface. The major concern relates to healing problems, mainly mesh exposure. High weight meshes are not prone to shrinkage and had good Velcro-like effect, but on the other hand erosion to the vagina may be a problem. In order to facilitate integration of the graft and reduce its weight, orifices of 5 mm in diameter were made in a monofilament polypropylene mesh and the tensile strength at the interface was evaluated in an animal model.

Methods: Ten adult female Wistar rats underwent implant of a 11 x13 mm 80 mg/m² meshes in the subcutaneous abdominal region. Half of the animal received the plain mesh and half the mesh with helper orifices, which reduced the mesh weight to 65 mg/m². After 90 days, the animals were sacrificed and the abdominal walls were removed en bloc and the tensile strength was immediately measured using a universal essay machine with a high sensitivity tensiometer. Force was applied to the extremity of the mesh until it was completely removed from the tissue. The force was measured in Newton (N) and Kruskal-Wallis test was used for statistical analysis.

Results: There was a tendency to the increment of the tensile strength resistance at the interface in the group with helper orifices, although it was not statistically significant (p value = 0.406). Figure 1 shows the pattern of the break point in each group.

CONCLUSION: Helper orifices diminished the mesh weight without impact on tensile strength at the interface mesh-tissue. This feature may be useful in the clinical setting.
ABSTRACT 228

**IN VIVO** EXPRESSIO**N OF TGF-ß1 IN SPINAL CORD INJURY BLADDERS AND **IN VITRO** EFFECTS ON BLADDER SMOOTH MUSCLE CELL CONTRACTION AND REMODELING

Aron Parekh¹, Rebecca A. Long¹, Michael B. Chancellor², Michael S. Sacks¹

¹Department of Bioengineering, University of Pittsburgh, Pittsburgh, PA
²Department of Urology, University of Pittsburgh, Pittsburgh, PA

**Introduction:** The changes in bladder smooth muscle cell (bSMC) orientation and mass soon after spinal cord injury (SCI) contribute to the structural remodeling and resulting dysfunction of the bladder wall. Transforming growth factor-ß1 (TGF-ß1) is highly upregulated after SCI in bladder tissue and induces hypertrophy and increased collagen production in bSMCs. However, the effects of TGF-ß1 on bladder smooth muscle cell function and interactions with the extracellular matrix are still unknown. The present study was designed to identify the **in vivo** expression and distribution of TGF-ß1 in SCI bladders and to assess the **in vitro** impact of TGF-ß1 on bSMC contractile and remodeling properties.

**Methods:** 5 µm cross- and lateral- (en face) sections of bladders from control and 10-day post-surgical, spinalized Sprague-Dawley rats were incubated with an anti-TGF-ß1 primary antibody and visualized with a streptavidin-Cy3 conjugate using fluorescent microscopy. Anchored collagen gels were utilized as tissue analogs for bladder wall to assess bSMC contractile properties. Macroscopic contraction was measured with digital video microscopy in control and TGF-ß1 (1 ng/ml) cases. Collagen reorganization in the gels was quantified using small angle light scattering to determine the degree of collagen fibril orientation as an indicator of bSMC remodeling.

**Results:** Both cross- and lateral-sections of control and rat SCI bladder tissue expressed TGF-ß1; however, the intensity and distribution of TGF-ß1 was significantly greater in the detrusor of the SCI bladders (Fig. 1). Treatment of bSMCs with exogenous TGF-ß1 caused significant increases in collagen gel contraction over a 24 hr period (Fig. 2). These increases in contraction were paralleled by increases in collagen gel remodeling. TGF-ß1 induced a higher degree of collagen fibril alignment by bSMCs.

**Conclusion:** TGF-ß1 expression is increased early on after spinal cord injury in the detrusor and is found throughout the tissue. Both contractile and remodeling properties of bSMCs were augmented with TGF-ß1. These results suggest that TGF-ß1 alters bSMC interactions with the surrounding extracellular matrix that could lead to altered local tissue organization and subsequent dysfunction.

![Fig. 1. TGF-ß1 fluorescent staining of a lateral-section of (A) normal and (B) SCI bladder.](image)

![Fig. 2. Collagen gel contraction by bSMCs in (A) control and (B) TGF-ß1 cases.](image)

**Source of Funding:** NIH T32 DK007774 training grant
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- Outstanding Paper Award -

TISSUE RESPONSE TO SURGICAL ENERGY DEVICES

Courtney K. Phillips*, Gregory W. Hruby, Evren Durak, Daniel Lehman, Peter A Humphrey, Mahesh M. Mansukhani, Jaime Landman

Introduction: There is minimal data available on the effects of surgical energy devices on nonvascular tissues. As such, we quantified the lateral thermal damage associated with contemporary energy-based surgical devices (ESD): the Harmonic ACE® (Ethicon Endosurgery, Cincinnati OH), a prototype bipolar device known as the Trisector (Gyrus, Maple Grove MN), the Harmonic LCS-C5® (Ethicon Endosurgery, Cincinnati OH) and the LigaSure V® (US Surgical Inc., Valley Lab, Boulder CO).

Methods: Twenty four pigs were divided into four groups, one group for each ESD tested. In situ segments of bladder, stomach, small bowel, colon, ureter, peritoneum, arteries, and veins were exposed to the surgical energy devices. Each tissue then underwent histopathological evaluation with hematoxylin and eosin staining to quantitate the lateral energy spread. During deployment of each ESD, the blade temperatures of each device were measured using a thermal camera.

Results: The Trissector had the lowest mean blade temperature (97.84°F) but created the greatest amount of full thickness (4.8-8.6 mm) and superficial lateral (6-9.2 mm) energy damage in six of the eight tissues examined. The LigaSure’s average blade temperature was the second lowest (103.14°F) and it produced the greatest energy spread in small bowel (superficial 5.8mm, full thickness 4.8mm) and colon (superficial 4.4 mm, full thickness 4.4 mm). The ACE was the hottest of all ESD tested (220.5°F), and the LCS-C5 was the second hottest (205.58°F). The Harmonic ACE produced the least full thickness damage in 4 tissues (0.6 mm-3 mm) and the least superficial damage in six tissues (1.5mm-3.8 mm). The LCS-C5 produced the least full thickness damage in three tissues (1.3-4.4 mm) and the least superficial damage in two (ureter 1.95 mm, artery 2.7 mm).

Conclusions: The Harmonic ACE and LCS-C5 produced the least amount of thermal damage in the different tissues tested. The damage caused by ESD appears does not correlate with blade temperature, but rather is more dependent on other factors including the time of transection, inherent tissue properties, and the vascular heat-sink effect of each tissue.
THE EFFECT OF INTRALUMINAL CONTENT ON THE Bursting STRENGTH OF VESSELS LIGATED WITH ULTRASONIC SHEARS

Courtney K. Phillips*, Gregory W. Hruby, Daniel S. Lehman, Pun Wei Hong, Evren Durak, and Jaime Landman

Introduction: Vessel sealing energy devices are among the most important tools for maintaining intracorporeal hemostasis during laparoscopic surgery. While efforts have been made to optimize bursting strength, no studies have evaluated the function of these devices under different physiologic conditions. We evaluated the changes in bursting pressure as a function of vessel intraluminal content during ultrasonic ligation.

Materials and Methods: Bursting trials were performed on the vasculature of 13 domestic pigs. Blood vessels were distended with blood of different hematocrit concentrations or an albumin solution of varying protein content. The vessel size and bursting pressure (BP) of each vessel was recorded after ligation with ultrasonic shears.

Results: Results of bursting trials can be seen in Tables I and II. In 0-3mm arteries and in all veins, there was statistically significant increase in the BP between vessels ligated at a supraphysiologic HCT of 50.6 compared to those ligated at all other normal or below-normal HCT. Similarly, there was an increase in BP between vessels ligated at 8% albumin (supraphysiologic) versus 4% albumin (physiologic concentration). Vessels 3.1-5mm ligated at HCT 50.6 manifested higher BP compared to 2 of the 6 lower hematocrits tested in arteries and veins.

Conclusion: In the normal physiologic range, there is no difference in vessel BP. Supraphysiologic intraluminal hematocrit and albumin increase the BP of small vessels ligated with the Harmonic ACE®.

Table I: Bursting Pressures (in mmHg) of Vessels Ligated with Varying Intraluminal Hematocrit Concentrations

<table>
<thead>
<tr>
<th>HCT</th>
<th>0</th>
<th>4.5</th>
<th>4.9</th>
<th>17.8</th>
<th>26.2</th>
<th>28.2</th>
<th>50.6</th>
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<tr>
<td>0-3mm Veins</td>
<td>133.3†</td>
<td>157.2‡</td>
<td>208.7*</td>
<td>153.1$</td>
<td>219.4€</td>
<td>193.9¥</td>
<td>407.4†‡*$£¥</td>
</tr>
<tr>
<td>3.1-5mm Veins</td>
<td>59.6†</td>
<td>188.8</td>
<td>NA</td>
<td>332.6</td>
<td>129.4€</td>
<td>107</td>
<td>473.4†£</td>
</tr>
<tr>
<td>0-3mm Arteries</td>
<td>439.5†</td>
<td>313‡#</td>
<td>413.7*</td>
<td>337.2$∞</td>
<td>456.1€</td>
<td>592.2¥#∞</td>
<td>847.3†‡*$£¥</td>
</tr>
<tr>
<td>3.1-5mm Arteries</td>
<td>366.3</td>
<td>513.2</td>
<td>326.1*</td>
<td>347.5$</td>
<td>554.2</td>
<td>453.8</td>
<td>501.1*$</td>
</tr>
</tbody>
</table>

† ‡ * $ £¥ # ∞ = Bonferroni correction

Table II: Bursting Pressures (in mmHg) of Vessels Ligated with Vary Intraluminal Protein Concentrations

<table>
<thead>
<tr>
<th>Albumin Concentration</th>
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<th>2%</th>
<th>4%</th>
<th>8%</th>
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<td>159.3</td>
<td>196.5</td>
<td>105.4†</td>
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<td>3.1-5mm Veins</td>
<td>167.7</td>
<td>109.9</td>
<td>58.8</td>
<td>234.0</td>
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<tr>
<td>0-3mm Arteries</td>
<td>355.2*</td>
<td>474.5</td>
<td>353.1†</td>
<td>593.4*</td>
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<td>3.1-5mm Arteries</td>
<td>265.15</td>
<td>228.3</td>
<td>358.3</td>
<td>NA</td>
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</tbody>
</table>

† ‡ * $ £¥ # ∞ = Bonferroni correction
ABSTRACTS – Session 2

ABSTRACT 231

DOES THE METHOD OF SECURING THE DORSAL VENOUS COMPLEX (DVC) DURING ROBOT-ASSISTED RADICAL PROSTATECTOMY AFFECT APICAL MARGIN RATES: A PROSPECTIVE STUDY

Sanjay Razdan

Introduction and Objective: The apex is the most common site of positive surgical margins in patients undergoing Robot-Assisted Radical Prostatectomy. Various techniques to reduce the positive apical margin rate have been proposed. We conducted a prospective study to evaluate the impact of three different modalities of securing the dorsal venous complex (DVC) on apical margin rates during robot-assisted radical prostatectomy.

Methods: Thirty patients (Mean age: 63.4 years) with clinical T1c carcinoma prostate who underwent robot-assisted radical prostatectomy were included in the study. The patients were prospectively divided into 3 groups based on the primary method of dorsal venous complex (DVC) control:

- Group A (N=12): Suture ligation
- Group B (N=11): Laparoscopic Vascular Stapler
- Group C (N=7): Enseal Device (SurgRx, Palo Alto, CA)

The 3 groups were comparable with respect to age, clinical stage (T1c), biopsy Gleason Score (6-7), and preoperative PSA (2.6-12.9). However, while Group A patients were generally those with smaller DVC’s and a lower body mass index (BMI), those in Groups B and C tended to have wider DVC’s and a higher body mass index. The final pathologic report was then compared in the three groups with respect to positive margins.

Results: Positive apical margins occurred in only two of the thirty patients (6.6%) in this prospective cohort. One patient each in Group A (Suture ligation) and Group B (Laparoscopic Vascular Stapler) had a positive apical margin. All 7 patients in Group C had negative apical margins. This did not reach statistical significance considering the smaller number of patients in Group C.

Conclusions: Our prospective study did not demonstrate a statistically significant advantage of any one modality of securing the Dorsal Venous Complex (DVC) on positive apical margin rate during Robotic-Assisted Radical Prostatectomy in patients with clinical T1c carcinoma prostate.
THE USE OF VIDEO GAME PERFORMANCE TO PREDICT ROBOTIC SURGERY SKILL

Christopher A. Rippel¹, Benjamin R. Stockton¹, Daniel M. Ricchiuti¹, Stephen V. Jackman¹, Timothy D. Averch¹

¹Department of Urology, University of Pittsburgh School of Medicine, Pittsburgh, PA

Introduction: The use of robotic surgery in urology is gaining widespread acceptance. However, resident training and skill assessment are restricted by limitations in robotic procedures and equipment availability. Therefore, the identification of surrogate markers of robotic surgery skill, such as video game skill, would be of value to training surgeons. In order to establish video game skill as a surrogate marker for robotic surgery skill, we investigated the association between these two metrics.

Methods: We enrolled 24 subjects (14 medical students, 7 residents, and 3 faculty; 19 male, 5 female; mean age 28.8±5.7 yrs). Past video game experience, training level, and surgical experience were collected. Subjects performed a series of tasks in three video games (snowboarding, tennis, and auto racing). Subjects were evaluated subjectively for hand-eye coordination and objectively using the statistics of the video games (score, time, crashes, etc.). Subjects also completed a series of tasks on the da Vinci surgical robot including placing rings, passing a rope, running a stitch, and tying a knot. Subjects were evaluated subjectively for hand-eye coordination and objectively for time to complete each task and errors made.

Results: A better subjective rating of auto racing performance (p=0.04), a higher score on the auto racing task (p=0.02), and fewer crashes on the auto racing task (p=0.01) were all associated with a shorter amount of time to complete the rope passing task. Furthermore, a better subjective rating of the auto racing task was associated with a lower time to complete the knot-tying task (p=0.03). These faster times were not associated with increased errors. Significance was generally maintained for these associations when controlled for amount of prior video game experience. The amount of prior video game experience was not significantly associated with overall robotic surgery performance (p=0.72). Several additional comparisons between video game and robotic skills trended towards, but did not reach, significance.

Conclusion: We have shown that certain aspects of video game playing are associated with more rapid completion of both simple and complex robotic surgery tasks, without an increased number of errors. Our data suggest that the association between video game and robotic surgery skill is valid for both experienced and inexperienced gamers. These findings support the use of video games as a potential predictor of robotic surgery skill.
ABSTRACTS – Session 2

ABSTRACT 233

PRE-EXISTING RENAL INSUFFICIENCY IS NOT A CONTRAINDICATION TO RENAL CRYOABLATION


Purpose: Renal cryoa blation has been shown to have negligible impact on renal function for patients presenting with normal renal function. However, the effect of renal cryoa blation on patients with preoperative renal insufficiency has not been reported. The purpose of this investigation is to determine the creatinine level changes for patients who undergo renal cryoablation and have preexisting renal insufficiency.

Materials and Methods: A retrospective review of patient charts was performed for patients who had undergone renal cryoablation. For the purpose of this analysis renal insufficiency was defined as a creatinine level > 1.3 mg/dL. Only those patients with pre cryoablation renal insufficiency and for whom both pre and post operative creatinine levels were known were included in the analysis. Changes in creatinine levels for the two populations were compared using the Student’s t-Test.

Results: Thirty-eight (38) patients were identified who had known pre and post operative creatinine levels. Of the 38 patients, 31 (81.6%) had normal renal function prior to cryoablation. Their average pre and post treatment creatinine levels were 0.99 ± 0.17 and 0.98 ± 0.23, respectfully (p=0.70). For the seven patients with renal insufficiency prior to cryoablation (18.4%), their pre and post operative creatinine levels were 2.28 ± 1.45 and 2.13 ± 1.22, respectfully (p=0.21). No patients with renal sufficiency prior to cryoablation had insufficiency after treatment and the largest change in creatinine level was 0.4.

Conclusions: Renal cryoablation appears to have minimal effect as measured by serum creatinine on the renal function of patients regardless of their pre cryoablation renal function status. This suggests that renal cryoablation lives up to its promise as a truly nephron-sparring technique that is minimally morbid for a wide range of patients. This modality should not be withheld as an option based on preoperative renal insufficiency.
INCREASING THE NUMBER OF BIOPSY CORES TAKEN BEFORE RENAL CRYOABLATION DECREASES DIAGNOSTIC UNCERTAINTY


Purpose: Renal cryoablation has been established as a primary treatment for small renal masses. Biopsy is performed intraoperatively just prior to initiation of freezing and typically consists of one core being taken. This methodology was done to reduce the potential of seeding tumor through blood spill or along the track. It is also associated with a relatively high yield of nondiagnostic cores. There have been no reports of tumor formation thought to be due to biopsy seeding prior to renal cryoablation. As such, in March 2005, we began to take three biopsy cores rather than one in an attempt to decrease our nondiagnostic rate.

Materials and Methods: Biopsy results were retrospectively reviewed for patients who underwent renal cryoablation between February 2001 and May 2006. Findings were stratified according to the number of cores taken which was either one or three. Tests for significance were performed using Fishers Exact Test to determine if there was a statistically significant difference in the nondiagnostic rates and the cancer yield rates.

Results: Eighty-One (81) biopsy results were reviewed. Of those, a single core was taken from 64 (79.0%) lesions. Of these 35 (54.7%) were malignant and 11 (17.2%) were nondiagnostic. The remaining 17 (21.0%) had 3 cores taken; 12 (70.5%) of which were malignant and none (0%) were nondiagnostic. The p-values for cancer yield rates and nondiagnostic rates were 0.108 and 0.280, respectfully.

Conclusions: Using a three core biopsy strategy resulted in a 15% increase in cancer yield and a 17% reduction in nondiagnostic rate. These results are not significant but we believe it may be due to the relatively small number of 3 core patients in our series. Continued investigation is warranted and underway.
THE USE OF HIGH RESOLUTION OPTICAL COHERENCE TOMOGRAPHY TO EVALUATE PROSTATE AND SEMINAL VESICLES

Shah Ketul, Thaly Rahul, Palmer Kenneth, Patel Vipulul.

Center for Robotics and Computer assisted surgery, Division of Urology, The Ohio State University, Columbus, Ohio.

Objective: Optical coherence tomography (OCT) is novel technology, recently developed to provide high resolution, cross sectional images of human tissue with a 2 mm depth of perception. The objective of this bench study was to explore the feasibility of OCT for the evaluation of prostate and seminal vesicles (SV). In this feasibility study, we used OCT to image prostate and SV in robotic prostatectomy specimens and the images were correlated with histopathology.

Methods: Ten prostatectomy specimens were removed and then passed off for systematic OCT imaging. The small portable machine allows the analysis to be performed in the OR suite in under 5 minutes. The specimen was systematically examined to image the normal prostate tissue, benign prostatic nodules, prostate cancer, apical and vesical margins, neurovascular bundles and SVs. The OCT images were directly compared to the histopathology images from the same areas. After understanding the OCT images, 50 robotic prostatectomy specimens were analyzed by OCT. Predictions were made regarding positive surgical margin, SV involvement, capsular invasion and presence of neurovascular bundles (NVB). The OCT image predictions were compared with the final histopathology.

Results: A total of 1000 OCT images were taken and analyzed. Out of 50 specimens, 44 had T2 disease, 6 had T3 disease with an average Gleason’s score of 6.6 (range 6 to 10) and 4 had positive surgical margins. We predicted 13 specimens to have positive margins based on OCT images out of which 3 were truly positive and 10 were falsely positive. Based on OCT images, 37 specimens were predicted to have negative margins out of which 36 were truly negative and 1 was falsely negative. We found the sensitivity, specificity, positive predictive value and negative predictive value to be 75%, 78%, 23% and 97% respectively. The seminal vesicles invasion was found in 2 cases out of which 1 was picked up as abnormal area on OCT and other was missed by OCT.

Conclusion: Our initial feasibility study established the template for the visual OCT characteristics of the prostate, SV, nerve bundles and cancerous tissue. The negative predictive value of evaluating surgical margins was high. There could be a potential for this technology to replace the use of intra-operative frozen section analysis. Further study is underway.
ABSTRACTS – Session 2

ABSTRACT 236

AUGMENTED REALITY SURGICAL SUITE FOR ROBOTIC SURGERY

Alok Shrivastava, Mani Menon

Introduction: Currently available surgical robot da Vinci Surgical System has a stereoscopic display for the surgeon and 2D display for assistants and other personnel in the operating room. This limitation has made assisting, training and mentoring difficult due to the different visual perspectives. To address these issues, we have built a robotic surgical suite with a stereoscopic projection-based display system.

Methods: The surgical suite has a 29’ x 24’ operating room and a 6.5’ x 24’ projection room. The operating room houses the da Vinci system. This room can seat the surgical team and 12 to 15 observers. It has two 80” x 60” stereoscopic displays for surgical video feed; two 42” LCD panels for console control close-up and auxiliary data display. The screens’ placement was tested in a virtual reality architectural simulation program for arrangements during various urologic robotic procedures. The size and placements of the screens were optimized for ergonomic viewing. The findings of the VR simulations were confirmed in a warehouse simulation of the arrangements before construction. All the operating room personnel have an unobstructed view of at least one stereoscopic screen without distortion. Screen surface facing the operating room was made by 5 mm toughened glass, allowing for chemical cleaning of the room. The surgical robot outputs two optical channels, one for the right eye and another for the left eye. The video signals are fed into 2x2 stacks (one stack for each display) 3 chip DLP projectors (10,000 lumens) in the projection room. The projection beams from the DLP projectors are polarized by a set of 45 and 135 degree linear polarizer for right and left eyes. The projection beams are focused on the screen through a set of mirrors. The projected image is viewed through special polarized glasses to give a stereoscopic vision.

Results: The surgical suite was commissioned in May 2004. Since then we have performed more than 900 robotic urologic procedures, including radical prostatectomy, radical cystectomy, nephrectomy, partial nephrectomy, and sacrocolpopexy in this facility. The OR arrangement models created before construction were used without any setup. We had no failure of display during a procedure. The assistants and the trainees now observe live robotic surgery in a totally immersive environment with stereoscopic vision and auxiliary data displayed in an ergonomic manner.

Conclusion: The augmented reality surgical suite is a major advancement over standard display of the da Vinci Surgical System by providing a stereoscopic perspective to all OR personnel.
VIDEO-ASSISTED PARTIAL NEPHRECTOMY THROUGH MINILAPAROTOMY FOR TECHNICALLY CHALLENGING RENAL TUMORS

Byung Hyun Soh, Woong Kyu Han, Joo Wan Seo, Hyung Joon Kim, Koon Ho Rha, Seung Choul Yang

Department of Urology, College of Medicine
Urological Science Institute and Brain Korea 21 Project for Medical Science
Yonsei University, Seoul, Korea

Introduction: Nephron-sparing surgery has emerged as the treatment of choice for small renal mass. We report our experience with Video-Assisted minilaparotomy (VAMS) partial nephrectomy in technically challenging cases.

Methods: Between June 2003 and March 2007, 21 patients underwent VAMS-PN for renal tumors. Technically challenging cases included centrally located tumors (5), hilar tumors (2), tumors in a single kidney (6), and large (> 4cm in diameter) tumors (12). We performed partial nephrectomy using a VAMS technique and maintained renal hypothermia using the ice slush bag technique.

Results: VAMS partial nephrectomy was successful in all cases. Mean tumor size was 4.9 cm (range 1.3 to 8), 6 patients had a solitary kidney. Mean operative time was 192 minutes (range 126 to 327). Mean cold ischemic time was 43 minutes (range 23 to 85), mean blood loss was 150 ml (range 50-600). Histopathology confirmed renal cell carcinoma in 15 patients (71%). All patients had negative surgical margins. Mean postoperative serum creatinine level was similar with preoperative serum creatinine level (1.35 vs. 1.36 mg/dl).

Conclusions: VAMS partial nephrectomy can be performed successfully even in technically challenging cases.

* This work was supported by the Brain Korea 21 Project for Medical Science, Yonsei University
THE EFFECT OF ARGON GAS PRESSURE ON ICE BALL SIZE AND RATE OF FORMATION

Preston Sprenkle*, Andrew Edelstein, Pun Wai Hong, Gregory W Hruby, Jaime Landman,

New York, NY

Introduction and Objective: Cryoablation utilizes the Joule-Thomson effect, the movement of high-pressure argon gas from an inner chamber into an outer chamber of the cryoprobe, to achieve very low temperatures. We evaluated the correlation of ice ball rate of formation and overall size as a function of initial gas tank pressure.

Methods: All cryoablation trials were performed in a standardized system consisting of a transparent gelatin (Kraft, Knox Gelatin, Glenview, IL) molds at room temperature using 1.47 mm cryoablation probes (IceRod, Oncura, Plymouth Meeting, PA). A fixed template was used to evenly and reliably secure 4 thermocouples at fixed distances (1.0, 1.5, 2.0 and 2.5 cm) from the cryoablation probe. The cryoprobe was activated for a single 8 minute freeze cycle. Ice ball size and the rate of ice ball formation were documented for initial tank pressures ranging from 4500 to 3200 psi (100 psi intervals). Time lapse photography was used to document ice ball size at one minute intervals. The size of the ice ball was precisely measured using standardized measurement techniques. Temperature data for each thermal couple was documented at 3.4 second intervals for each trial. For statistical analysis, groups were stratified by low (3200-3500 psi), intermediate (3600-3900 psi) and high starting pressure (>4000 psi). Differences in the rate of ice ball diameter change and temperature change were analyzed using ANOVA techniques.

Results: Within each group a mean of 5 ice ball trials was performed (Median 5, range 2-10). The low, intermediate and high pressure systems reached a mean minimum temperature of -1.11, -7.40, and -9.53°C respectively when measured at 1cm (p<0.001). The mean rate of temperature change was -0.19, -0.21 and -0.24°C/3s for the low, intermediate and high starting pressure systems respectively (p<0.001). The mean maximum ice ball diameter was 26.5 mm for the low pressure group and was significantly less (p<0.001) than the intermediate (29.7 mm) and high pressure (30.3 mm) groups. Mean growth rates were 3.33, 3.71, and 3.79 mm/min respectively (p=0.24).

Conclusions: In accordance with the Joule-Thomson effect, higher gas pressures used for cryoablation in a transparent gel model demonstrate statistically significant lower temperatures, faster decreases in temperature, and formation of a larger ice balls than lower gas pressures. Ice ball size and rate of formation have clinical significance as the rate of ice ball formation has been shown to be correlated with the size of the indeterminate and complete ablation zones.
ABSTRACT 239

120 W LITHIUM TRIBORIDE (LBO) LASER PHOTOSELECTIVE VAPORIZATION PROSTATECTOMY (PVP) FOR SYMPTOMATIC BENIGN PROSTATIC HYPERPLASIA (BPH)

Jeremy B. Tonkin, Motoo Araki, Po N. Lam, Daniel J. Culkin, Glenn M. Sulley and Carson Wong

Department of Urology, University of Oklahoma Health Sciences Center, Oklahoma City, OK
920 Stanton L. Young Blvd., WP 3150, Oklahoma City, OK

Introduction: LBO laser PVP is a relatively new technology for the treatment of lower urinary tract symptoms (LUTS) secondary to BPH. We review our initial experience using the 120 W LBO laser system.

Methods: We prospectively evaluated our initial experience with LBO laser PVP. Patients who failed either medical therapy or surgery (thermal, interstitial laser, holmium laser or transurethral prostate resection) underwent LBO laser PVP by a single surgeon (CW). All had pre-operative International Prostate Symptom Score (IPSS), Sexual Health Inventory for Men (SHIM) score, American Society of Anesthesiologists (ASA) risk score, serum prostate specific antigen (PSA), maximum flow rate (Qmax) and post void residual (PVR) determinations as well as volumetric measurements via transrectal ultrasonography (TRUS). Under general anesthesia, transurethral PVP was performed using a 120 W LBO side-firing laser system through a 23 Fr continuous-flow cystoscope with normal saline irrigant. Laser times, operative times and energy usage were recorded. Voiding trials were performed two hours post surgery. IPSS, SHIM, Qmax and PVR were evaluated 1, 4 and 12 weeks post surgery. TRUS and PSA measurements were also obtained at the 12 week post-operative evaluation.

Results: Eighty-five consecutive patients were identified. Their mean age was 69 ± 9 years, with a mean ASA score of 2.3 ± 0.6. The mean prostate volume was 76 ± 45 cm³ and the mean PSA was 2.2 ± 2.5. Mean laser time and energy usage were 12 ± 8 minutes and 82 ± 51 kJ, respectively. All were outpatient procedures with 46/85 (54%) patients catheter-free at discharge. Five patients required catheter drainage for one week. One patient developed a urinary tract infection. Ten patients had persistent hematuria for greater than one week. Three patients had persistent urinary retention due to detrusor failure. No urethral strictures or urinary incontinence were noted. All patients were able to discontinue their prostate medications following surgery. Mean IPSS decreased significantly from 26 to 11, 8 and 6 (p<0.05) at 1, 4 and 12 weeks, respectively. Qmax increase and prostate size reduction showed significant improvement 3 months post-surgery. The SHIM score did not change postoperatively.

Conclusion: Our initial results demonstrate that 120 W LBO laser PVP is safe and effective for the treatment of LUTS secondary to BPH. Additionally, there appears to be no detrimental effect on erectile function.
HIGH POWER (80 W) POTASSIUM-TITANYL-PHOSPHATE (KTP) LASER PHOTOSELECTIVE VAPORIZATION PROSTATECTOMY (PVP) FOR SYMPTOMATIC BENIGN PROSTATIC HYPERPLASIA (BPH)

Jeremy B. Tonkin, Motoo Araki, Po N. Lam, Daniel J. Culkin, Pamela E. Fox, Glenn M. Sulley and Carson Wong

Department of Urology, University of Oklahoma Health Sciences Center, Oklahoma City, OK
920 Stanton L. Young Blvd., WP 3150, Oklahoma City, OK

Introduction: KTP laser PVP is a relatively new technology for the treatment of lower urinary tract symptoms (LUTS) secondary to BPH. We review our initial experience.

Methods: We prospectively evaluated our initial 12-month experience with an 80 W KTP laser PVP. All patients had pre-operative International Prostate Symptom Score (IPSS), American Society of Anesthesiologists (ASA) risk score, serum prostate specific antigen (PSA), maximum flow rate (Qmax) and post void residual (PVR) determinations as well as volumetric measurements via transrectal ultrasonography. Transurethral PVP was performed using an 80 W KTP side-firing laser system. Voiding trials were performed two hours post surgery; and if unable to void, a urethral catheter was replaced. International Prostate Symptom Score (IPSS), maximum flow rate (Qmax) and post void residual (PVR) were measured preoperatively and at 1, 4, 12, 24 and 52 weeks post surgery.

Results: One hundred sixty consecutive patients were identified. Their mean age was 70 ± 9 years, with a mean ASA score of 2.4 ± 0.6. The mean prostate volume was 72 ± 50 cm³, with a mean PSA of 2.2 ± 2.5. Mean laser time and energy usage were 33 ± 30 minutes and 99 ± 90 kJ, respectively. All were outpatient procedures with 98/160 (61%) patients catheter-free at discharge. Twenty-eight patients required catheter drainage for one week. Thirteen patients developed urinary tract infections. Fourteen patients had persistent hematuria for greater than one week. Three patients developed bladder neck contractures requiring intervention. Three patients had persistent urinary retention due to detrusor failure. No urethral strictures or urinary incontinence were noted. Mean IPSS decreased significantly from 27 to 15, 11, 9, 8 and 6 (p<0.05) at 1, 4, 12, 24 and 52 weeks, respectively. Qmax and PVR values also showed statistical significant improvement.

Conclusion: Our initial results demonstrate that KTP laser PVP is safe and effective for the treatment of LUTS secondary to BPH.
ABSTRACT 241

ACCURACY OF PROSTATE VOLUME MEASUREMENT BY TRANSRECTAL ULTRASOUND (TRUS) IN PATIENTS UNDERGOING ROBOT-ASSISTED LAPAROSCOPIC PROSTATECTOMY (RALP)

Jeremy B. Tonkin, Motoo Araki, Po N. Lam, Daniel J. Culkin, Glenn M. Sulley and Carson Wong

Department of Urology, University of Oklahoma Health Sciences Center, Oklahoma City, OK
920 Stanton L. Young Blvd., WP 3150, Oklahoma City, OK

Introduction: Removal of large prostate glands poses a significant challenge for both open and minimally invasive approaches. Accurate estimation of prostate volume is important in the preoperative evaluation. We review our initial RALP experience to determine the accuracy of prostate volumes measured by TRUS.

Methods: Patients undergoing RALP for clinically localized prostate adenocarcinoma underwent TRUS with a 7.5-MHz transducer. Prostate volumes were estimated by their three-axis linear dimension measurements by TRUS using a tissue density of 1.05 g/cc and the standard formula for an ellipsoid object. All TRUS measurements and RALP were performed by a single surgeon (CW). The prostate and seminal vesicles were removed en bloc and kept in formalin until they were processed. The weight of the prostate excluding the seminal vesicles was measured and recorded. Prostate volumes were estimated using a tissue density of 1.0 g/cc. The TRUS and actual prostate volumes were compared.

Results: Fifty consecutive patients were identified, having a mean age of 61 ± 7 years and T1c disease preoperatively. The mean TRUS and actual prostate volumes were 56 ± 24 and 47 ± 17 cm³, respectively. Mean TRUS prostate volumes were larger by 19 % than the actual prostate volume (p<0.05). There was a linear correlation between TRUS (x) and actual (y) prostate volumes (y = 0.5951x + 13.684, R² = 0.7083).

Conclusion: Our initial results demonstrate that despite a consistent overestimation of prostate size, TRUS prostate volumetric measurement appears to correlate with the actual prostate volume. TRUS is thus a useful tool in the preoperative assessment of patients undergoing RALP.

Comparison of TRUS and actual prostate volume

\[ y = 0.5951x + 13.684 \]

\[ R^2 = 0.7083 \]
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DOES AGE AFFECT THE SAFETY AND EFFICACY OF POTASSIUM-TITANYL-PHOSPHATE (KTP) LASER PHOTOSELECTIVE VAPORIZATION PROSTATECTOMY (PVP)?

Jeremy B. Tonkin, Motoo Araki, Po N. Lam, Daniel J. Culkin, Pamela E. Fox, Glenn M. Sulley and Carson Wong

Department of Urology, University of Oklahoma Health Sciences Center, Oklahoma City, OK
920 Stanton L. Young Blvd., WP 3150, Oklahoma City, OK

Introduction: We evaluate the safety and efficacy of KTP laser PVP for the treatment of lower urinary tract symptoms (LUTS) secondary to benign prostatic hyperplasia (BPH) in patients of varying age groups.

Methods: We prospectively evaluated our initial 12-month KTP laser PVP experience. Patients were stratified into two groups: age<70 (Group I) and age≥70 (Group II). Transurethral PVP was performed using an 80 W KTP side-firing laser system. Voiding trials were performed two hours post surgery; and if unable to void, a urethral catheter was replaced. International Prostate Symptom Score (IPSS), maximum flow rate (Qmax) and post void residual (PVR) were measured preoperatively and at 1, 4, 12, 24 and 52 weeks post surgery.

Results: One hundred sixty consecutive patients were identified (74 Group I, 86 Group II), all of whom had outpatient procedures. The American Society of Anesthesiologists (ASA) risk score was significantly higher in Group II (2.2 vs. 2.5, p≤0.05). Elderly patients (Group II) had larger prostate volumes (61 vs. 81 cm³, p≤0.05), requiring longer laser time (28 vs. 38 min, p≤0.05) and higher energy (85 vs. 110 kJ, p≤0.05) than younger patients (Group I). IPSS, Qmax and PVR values showed significant improvement within each Group (p≤0.05). Qmax was higher in group I but IPSS and PVR values were similar between the two groups. The majority of patients were catheter free at discharge (61 vs. 55%, p=0.43). The incidence of retrograde ejaculation was higher in Group I (11 vs. 0%, p≤0.05). The incidence of other adverse events (urinary retention, hematuria, urinary tract infection, bladder neck contracture) did not show statistical significance. No urethral strictures or urinary incontinence were noted.

Conclusion: Despite a higher Qmax in the younger patient group, our experience suggests that age has little effect on the safety and efficacy of KTP laser PVP.
ABSTRACT 243

THE USE OF THE ENDO-GIA STAPLER VERSUS SUTURE LIGATURE FOR DORSAL VEIN CONTROL IN LAPAROSCOPIC PROSTATECTOMY: OPERATIVE OUTCOMES

Burak Turna, Mike M Nguyen, Bruno R Santos, Rodrigo Frota, Monish Aron, Robert J Stein, Jason M Hafron, Troy Gianduzzo, Inderbir S Gill.
Glickman Urological Institute, Cleveland Clinic Foundation, Cleveland, Ohio, USA

Introduction: Control of the dorsal vein complex during laparoscopic prostatectomy is achieved with either suture ligature or Endo-GIA stapling. We sought to identify differences in operative outcome between the two methods.

Methods: 120 patients who underwent laparoscopic prostatectomy from January 2005 to October 2006 were analyzed. 60 patients underwent suture ligature while 60 patients were treated with an Endo-GIA stapler. A multivariate analysis was performed to account for baseline patient and disease characteristics. Primary outcome variables evaluated included estimated blood loss, operative time, and positive margin rates.

Results: Baseline demographics were similar between the sutured and stapled groups for age (59.7 vs. 60.1 yrs p=0.674), BMI (29.2 vs. 28.5 p=0.237), preoperative PSA (5.3 vs. 5.7 p=0.5), Gleason’s score (6.4 vs. 6.3 p=0.294), clinical stage (77% vs. 88% T1c p=0.052) and preoperative SHIM score (19.4 vs. 19.6 p=0.813). Operative measures were not significantly different between the two groups for EBL (287 vs. 343 ml p=0.156) or operative time (234 vs. 223 min p=0.324). Apical margin involvement was not significantly different (12% vs. 7% p=0.121). Overall positive margin rate (30% vs. 18% p=0.020) and disease volume (22% vs. 13% “extensive” p=0.021) were higher among the sutured group. However, on multivariate analysis, the overall margin rate was not significantly different.

Table I. Operative outcomes

<table>
<thead>
<tr>
<th></th>
<th>Group 1 (suture)</th>
<th>Group 2 (stapler)</th>
<th>Univariate Analysis p value</th>
<th>Multivariate Analysis p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>EBL ± SD (ml)</td>
<td>287 ± 186</td>
<td>343 ± 245</td>
<td>0.156</td>
<td>0.156</td>
</tr>
<tr>
<td>Operative time ± SD (min)</td>
<td>234 ± 63</td>
<td>223 ± 66</td>
<td>0.324</td>
<td>0.324</td>
</tr>
<tr>
<td>Positive apical margin rate (%)</td>
<td>11.7%</td>
<td>6.7%</td>
<td>0.121</td>
<td>0.232</td>
</tr>
<tr>
<td>Positive overall margin rate (%)</td>
<td>30.0%</td>
<td>18.3%</td>
<td><strong>0.020</strong></td>
<td>0.140</td>
</tr>
</tbody>
</table>

Table II. Short term PSA and functional outcomes

<table>
<thead>
<tr>
<th></th>
<th>Group 1 (suture)</th>
<th>Group 2 (stapler)</th>
<th>Univariate Analysis p value</th>
<th>Multivariate Analysis p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSA recurrence at 3 months (%)</td>
<td>1.7%</td>
<td>1.7%</td>
<td>1.000</td>
<td>1.000</td>
</tr>
<tr>
<td>SHIM score at 3 months ± SD</td>
<td>9.0 ± 5.3</td>
<td>11.7 ± 7.4</td>
<td><strong>0.024</strong></td>
<td>0.058</td>
</tr>
<tr>
<td>Continence status at 3 months (%)</td>
<td>23.3%</td>
<td>31.7%</td>
<td>0.426</td>
<td>0.158</td>
</tr>
</tbody>
</table>

Conclusion: There was no difference in operative outcomes between sutured and stapled control of the dorsal vein complex in laparoscopic prostatectomy for EBL, operative time, or positive margin rate. Additional follow-up is needed to determine differences in functional outcomes.
ABSTRACT 244

IMAGING-ASSISTED ENDOSCOPIC SURGERY THE AMERICAN WAY:
DEVELOPMENT OF NOVEL 3D SURGICAL NAVIGATION SYSTEM

Osamu Ukimura,* Masahiko Nakamoto, Mihir Desai, Brian Herts, Monish Aron, Georges-Pascal Haber,
Tsuneharu Miki, Yoshinobu Sato, Makoto Hashizume, and Inderbir S Gill

Glickman Urological Institute, The Cleveland Clinic, Cleveland, OH, USA

A major limitation of current intraoperative surgical navigation tools, such as use of real-time ultrasound, is use of the 2-D image, which requires monitoring and interpretation by an experienced ultrasonographer, instead of the surgeon’s direct interpretation of the image. We recently developed and applied a novel surgical navigation system: Augmented Reality (AR). AR allows real-time, synchronized, precise superimposition of 3-D image onto the real live endoscopic view. This provides virtual visualization through opaque tissues -“look beyond what you can see”, i.e., being able to “see” the renal artery and/or vein through the renal hilar fat. The imaging modalities we have employed for AR include (a) intra-operative US, and (b) pre-operative CT or MRI. This novel surgical navigation system refined by us includes (i) “Color-coded zonal navigation” to provide 3D surgical road map for specific aims of each surgery, and (ii) “Predictive navigation and radar system”. Using our developed software, 4 sequential, color-coded zones were painted around the surgical target such as a renal tumor: the tumor was colored red, surrounded circumferentially by a 5 mm caution zone in yellow, a 10 mm recommended dissection zone in green, and >10 mm healthy renal tissue zone in blue. Predictive navigation can predict whether or not continuing in the current ongoing surgical plane will result in safe and accurate tumor excision. Surgical radar can demonstrate a circular mapping of future surgical outcomes, in a half-spherical space with a radius of any predetermined distance from the tip of the surgical instrument.

To our knowledge, we report the initial clinical experience of AR technology in laparoscopic urology. This surgical navigation system can potentially increase the precision during laparoscopic surgery in order to achieve better oncological and functional outcomes.
ABSTRACT 245

NEW FRONTIERS IN PNEUMATIC LITHOTRIPSY: THE DEVELOPMENT OF THE STONEBREAKER®

Paul Van Cangh¹, Jose Salvado¹, Stephan Luyckx¹, Sebastien Wese¹, Axel Feyaerts¹, Bernard Simon², Thierry Monnier², Roberto Barreiro², Alain Lebet²

¹Department of Urology, UCL Medical Faculty, Brussels, Belgium
²LMA Urology Suisse SA, Gland, Switzerland

Introduction: Pneumatic lithotripsy has gained a prominent position in the endourologist armamentarium, in recognition of its great effectiveness. Amongst the drawbacks of the existing devices are the high number of shocks required to fragment the hardest stones, the propulsion effect related to the mechanical action of the probe, and the dependence on external sources of energy. We tested the “StoneBreaker”, a new intracorporeal pneumatic lithotripter of second generation.

Material and methods: The StoneBreaker® is a compact device weighing approximately 500 g, entirely self contained, independent from an external source of energy and connecting lines. A disposable highly compressed carbon dioxide gas cartridge stores enough energy for a large size calculus. The expansion chamber and the hammer have been redesigned to generate a powerful shock when the CO₂ abruptly expands and forcefully project the hammer against the firing pin that transmits the energy to the probe held in close contact with the stone (see figures below). One major advantage of this device is the minimal displacement at the tip of the probe, despite the high energy of the mechanical shock. Typically, large size fragments are generated, expediting their extraction (a short video clip illustrates the procedure).

Results: We treated percutaneously 56 consecutive cases of large size and hard renal calculi having failed multiple ESWL sessions (50% Calcium oxalate monohydrate and 15% cystine). All stones could be fragmented in extractable fragments, with minimal trauma to the mucosa. Complications were related to the percutaneous approach itself, and not to the fragmentation process.

Conclusion: This simple and affordable device appears to be a real progress in the field of endourological lithotripsy. Our present experience, duplicated by others, is encouraging, and further developments are already underway.
ABSTRACTS – Session 2

ABSTRACT 246

TOTALLY BLOODLESS PERCUTANEOUS RENAL SURGERY


Purpose: Patients undergoing complex percutaneous renal surgery (PRS) are at increased risk for renal hemorrhage resulting from arterial pseudoaneurysms and arteriovenous fistula. These patients may require selective angio-embolization to arrest persistent hemorrhage. Patients at greatest risk are those requiring multiple nephrostomy tracts to perform PRS. We evaluated the feasibility and efficacy of intraoperative transarterial balloon occlusion of renal artery as a novel technique aimed at reducing blood loss while attempting to identify any iatrogenic vascular injury and treat if necessary in a series of high-risk patients.

Materials & Methods: Four patients with a variety of renal diseases (staghorn calculi: n=2; transitional cell carcinoma of the renal pelvis: n=1; ureteropelvic junction obstruction: n=1) undergoing PRS were selected to undergo trans-femoral renal angiography prior to initiating percutaneous access. The renal artery was identified and an occluding balloon was inflated in the main renal artery. The kidney was intermittently allowed to perfuse with heparinized saline flushed through the angiographic catheter to prevent clotting. Percutaneous renal access was then obtained under fluoroscopic guidance by the urologist with sequential dilation of the tract to 30 French. Multiple tracts were established as needed to perform the procedure. A nephrostomy tube was placed at the end of the procedure. The arterial occluding balloon was taken down at the completion of PRS and renal angiography repeated through the established angiographic catheter to identify any vascular injury. The angiographic catheter was then removed at the end of the procedure.

Results: Initial angiography revealed no abnormalities in all patients and balloon occlusion was successfully performed in all four patients (100%). Average number of renal access punctures was 2.75 (range 1-6). Both stone patients were stone free after surgery; the one patient who underwent resection of TCC had bulky grade 2 disease and was referred for nephroureterectomy. Subjective improved visualization during PRS was reported by the surgeon in all cases attributed to decreased bleeding. Mean EBL was less than 500 cc in all patients undergoing vascular control and operative time was 127 minutes (75 – 190 minutes). Post-PRS intraoperative angiography revealed no active bleeding vessels requiring embolization in any of the patients. No patient required transfusion intraoperatively and only one patient required single unit postoperatively. Mean serum creatinine levels pre-PRS and post-PRS were 1.0 mg/dl and 1.1 mg/dl, respectively.

Conclusion: Intraoperative balloon occlusion of renal artery is feasible and safe in patients undergoing complex PRS. Vascular control is a reasonable option for improving intraoperative endoscopic visibility while reducing renal hemorrhage in patients at high risk for bleeding.
NOVEL USE OF THE ENDOHOLDER DEVICE DURING ROBOTIC-ASSISTED LAPAROSCOPIC RADICAL PROSTATECTOMY: THE POOR MAN’S 4TH ARM EQUIVALENT

Kevin C. Zorn, Ofer N. Gofrit, Arieh L. Shalhav

Section of Urology, University of Chicago Pritzker School of Medicine, Chicago, Illinois

Purpose: During a standard, 6 port-setup, robotic-assisted laparoscopic radical prostatectomy (RLRP), two assistants are routinely required when using a 3-arm da Vinci system. The role of the 2nd assistant is often limited to isometric traction of both the colon and bladder during prostate dissection. Due to muscle fatigue and the lack of visualization their instrument in the operative field, repositioning of the 2nd assistant is often required. In an attempt to make more efficient and improve the safety of the 2nd assistant instrument, we describe the use of an adjustable, spring-loaded, articulating arm instrument holder (Endoholder; Codman, Raynham, MA, USA) during RLRP.

Materials and Methods: The Endoholder, initially described to facilitate laparoscopic renal surgery, consists of 4 components (table attachment, base rod, flexible extension arm and precision clamp). After robot docking, the instrument holder is quickly clamped to the table via the base rod over a sterile drape. Specifically during pelvic lymphadenectomy, posterior prostate dissection and bladder neck transaction, the grasping laparoscopic instrument is placed under direct vision and pulled in the necessary direction to optimize exposure. Once in the desired position, the set screw is tightened thereby precluding any inadvertent release of the open surface of the retractor. The Endoholder is also fastened securing the retractor in the desired position.

Results: In over 100 consecutive cases, the Endoholder has provided quick, reproducible retraction to facilitate exposure during RLRP, thereby reproducing the function of the da Vinci 4th arm. No complications have occurred with its use. The device further liberated the need for a dedicated 2nd scrubbed assistant (nurse/resident) to stand bedside. Minor repositioning of the device could easily be performed by the scrub nurse.

Conclusions: Use of the Endoholder during RLRP offers the benefit of a cost-effective equivalent to the retraction provided by the da Vinci 4th arm. Issues related to excessive force, instrument migration due to muscle fatigue and potential visceral injury from instrument manipulation are significantly reduced with this device. Furthermore, use of the Endoholder has eliminated the need for an additional bedside assistant.
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Outstanding Paper Awards:

FLEXIBLE ROBOTIC RETROGRADE RENOSCOPY: DESCRIPTION OF A NOVEL ROBOTIC DEVICE AND PRELIMINARY LABORATORY EXPERIENCE
Mihir M. Desai, Monish Aron, Inderbir S. Gill, Georges Pascal-Haber, Osamu Ukimura, Jihad H. Kaouk, Gregory Stahler, Federicio Barbagli, Christopher Carlson, Fredric Moll

KTP LASER ROBOTIC NERVE-SPARING RADICAL PROSTATECTOMY: DEVELOPMENT AND INITIAL CLINICAL EXPERIENCE
Troy Gianduzzo, Jihad Kaouk, Jose R Colombo Jr., Georges-Pascal Haber, Cristina Magi-Galluzzi, Jason Hafron, Monish Aron, Inderbir S Gill

PERCUTANEOUS CRYOABLATION OF KIDNEY LESIONS UNDER COMBINED REAL-TIME ULTRASOUND AND 3D CT SCAN NAVIGATION
Georges-Pascal Haber, Osamu Ukimura, Jose R Colombo Jr, Yi-Chia Lin, Philippe Koenig, Troy Gianduzzo, Monish Aron, Cristina Magi-Galluzzi, Inderbir S Gill, Jihad H Kaouk

TISSUE RESPONSE TO SURGICAL ENERGY DEVICES
Courtney K. Phillips, Gregory W. Hruby, Evren Durak, Daniel Lehman, Peter A Humphrey, Mahesh M. Mansukhani, Jaime Landman

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The paper review committee has been assembled by e-mail solicitation. A number of 62 reviewers from around the world accepted to participate. We gratefully acknowledge their contribution to the success of the meeting and thank them for taking the time to help in this process.

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