Welcome! The Engineering and Urology Society (EUS) is holding its 21st annual meeting on Saturday, May 20th, 2006 in Atlanta, GA together with the annual meeting of the American Urological Association. The EUS is dedicated to providing a forum where the latest tools and cutting-edge technology can be presented, as they pertain to either immediate or ambitiously foreseen urologic applications. The meeting is also meant to serve as a vehicle to shape future urologic practice by facilitating interactions among clinicians, academia and industry scientists. With this in mind, several exciting discussions have been planned for this year’s meeting. The program will include invited presentations and podium discussions in the morning and two poster scientific sessions in the afternoon. A wide variety of topics related to applied engineering, advances in endoscopy, urodynamics, ablation techniques, modeling and simulation, robotics, laparoscopy and telemedicine will be addressed.

Dr. Elspeth McDougall and Dr. Margot Damaser are the program chairpersons for this year’s meeting. They have constructed an exciting program that includes presentations by unparallel specialists in the morning session. Dr. de la Rosette must also be recognized for organizing the European Society of Urology Technology session focused on bladder cancer.

Since last year the EUS Society is affiliated with the Endourological Society under a common membership structure. Also Dr. Raju Thomas has organized the Robotics Working Group, dedicated to exploring and advancing the role of intraoperative robotics.

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 40 reviewers from around the world. Each paper received between 9 and 11 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 Awards were selected for the abstracts with the highest mean of the review grades. This year two papers tied with an equal score. The awards go to the French collaboration team from the Pierre et Marie Curie University, TIMC Lab, and KOELIS for their work on a CT and ultrasound image fusion and to the Johns Hopkins robotics team for a new robot for transperineal needle access of the prostate under MRI guidance.

In premiere this year, the society also presents the 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. Three reviewers have clearly distinguished themselves this year not only through hard work but also by impressively objectively assigning the scores. The awards go to Dr. Michael Muntener, Dr. Koon Ho Rha, and Dr. Felix Feldchtein.

The EUS abstracts will continue to be published in the Journal of Endourology. Last year’s abstracts can be found in the September 2005 issue of the journal: Vol. 19, No. 7: 899-921

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 are meeting today.

Thank you for your continued scientific support,

Louis Kavoussi, MD
Dan Stoianovici, PhD
**Method of Participation and Instructions for Claiming Credits**
Please be sure to swipe your Expo card when attending any activity for CME credit.

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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 4.0 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.
ENGINEERING AND UROLOGY SOCIETY

Saturday, May 20, 2006
Convention Center, Room A305, Atlanta, GA

Program Chair: Elspeth M. McDougall, MD
Co-Program Chair: Margot S. Damaser, PhD

7:00AM – 7:30AM Registration and Breakfast

7:30AM – 7:45AM Welcome and Introduction Louis Kavoussi, MD

7:45AM – 8:15AM Keynote Speaker Daniel Smith, MD
Surgical Simulation and the Introduction of Procedures: the New Paradigm

8:15AM – 9:15AM Surgical Simulation Jeffrey Cadeddu, MD
Validity Testing and the Role in Credentialing and Certifying
Tips on How to Create a Virtual Reality Simulator
Use of Models & Simulation in Product Development & Training
Questions & answers

9:15AM – 9:30AM Break

9:30AM – 10:30AM Panel on New Techniques for Monitoring and Diagnosing Voiding Function Kenneth Gustafson, MD
Daniel Yachia, MD
Dan Parker, MD
Derek Griffiths, MD

10:30AM – 10:45AM Awards Presentations Dan Stoianovici, PhD

10:45AM – 11:00AM Break

11:00AM – 12:00PM European Society of Urologic Technology Jean de la Rosette, MD
Hessel Wijkstra, PhD

12:00PM – 1:00PM Lunch Break

1:00PM – 2:30PM Poster Session 1
Basic Research Michael Fabrizio, MD
Peter Pinto, MD

2:30PM – 4:00PM Poster Session 2
Robotic Surgery Li-Ming Su, MD
Vip Patel, MD
<table>
<thead>
<tr>
<th>No.</th>
<th>Title</th>
<th>Presenting Author</th>
</tr>
</thead>
<tbody>
<tr>
<td>101</td>
<td>Evaluation of Novel Renal Bipolar Resection Morcellation Technique</td>
<td>Greg Hruby</td>
</tr>
<tr>
<td>102</td>
<td>An In-Vivo Evaluation of Flow Characteristics of a Novel Metal Ureteric Stent</td>
<td>Leslie Deane</td>
</tr>
<tr>
<td>103</td>
<td>Continuous Flow Flexible Cystourethroscopy: Feasibility Using an Evertig Urethral Access Sheath</td>
<td>Bela Denes</td>
</tr>
<tr>
<td>104</td>
<td>A Comparison of Laparoscopic, Video-Assisted Minilaparotomy, Open Partial Nephrectomy for the Small Exophytic Renal Mass</td>
<td>Koon Ho Rha</td>
</tr>
<tr>
<td>105</td>
<td>MRI-Guided Conformal Transurethral Thermal Therapy for Prostate Disease: In-Vivo Demonstration in a Canine Model</td>
<td>Rajiv Chopra</td>
</tr>
<tr>
<td>107</td>
<td>In Vitro Analysis of Lapra-Ty Clip Strength</td>
<td>James Borin</td>
</tr>
<tr>
<td>108</td>
<td>Study of Calculus Fragmentation and Retropulsion as A Function of Ho:Yag Laser Pulse Duration</td>
<td>Joel Teichman</td>
</tr>
<tr>
<td>110</td>
<td>Direct Visualization of Cortical Peritubular Capillary of Kidney Using a Magnifying Endoscopy</td>
<td>Yasuhito Funahashi</td>
</tr>
<tr>
<td>111</td>
<td>Forces Generated While Traversing A 15 French Stricture: A Comparison Between 17 and 18 French Cystoscopes and A 23 French Evertig Introducer Sheath</td>
<td>Kristina Williams</td>
</tr>
<tr>
<td>Session</td>
<td>Title</td>
<td>Presenter</td>
</tr>
<tr>
<td>---------</td>
<td>----------------------------------------------------------------------</td>
<td>-------------------</td>
</tr>
<tr>
<td>113</td>
<td>Interstitial Ultrasound Thermal Therapy of the Prostate: An Analytical Study</td>
<td>Chandrasekhar Thamire</td>
</tr>
<tr>
<td>114</td>
<td>Prophylactic Gelfoam to Prevent Bleeding After Percutaneous Renal Cryoablation in a Swine Model</td>
<td>Sompol Permpongkosol</td>
</tr>
<tr>
<td>115</td>
<td>Technique for Optimizing Tissue Yield From Needle Biopsy of Renal Parenchyma</td>
<td>Greg Hruby</td>
</tr>
<tr>
<td>116</td>
<td>Abdominal Compression Belt – an Easy Tool to Increase Efficacy of Eswl</td>
<td>Thorsten Bergsdorf</td>
</tr>
<tr>
<td>117</td>
<td>Autoflex Laser Applicator Combines Excellent Handling and Visibility in Urological Laser Surgery.</td>
<td>Thorsten Bach</td>
</tr>
<tr>
<td>118</td>
<td>Laparoscopic Multi-Purpose Retractable Tissue Dissector and Suture Passer</td>
<td>Frank Lai</td>
</tr>
<tr>
<td>119</td>
<td>Application of Ureteral Access Sheath During Ureteroscopy for Urolithiasis: an Analysis of Clinical and Mechanical Outcome</td>
<td>Prabhakar Pandey</td>
</tr>
<tr>
<td>120</td>
<td>In-Situ ESWL of Ureteric Stones – Still a Competetive Treatment Option</td>
<td>Thorsten Bergsdorf</td>
</tr>
<tr>
<td>121</td>
<td>Novel Technique for Radical Nephroureterectomy and Partial Resection of Bladder Cuff Through a Single Incision with the Video-Assisted Minilaparotomy Surgery (VAMS)</td>
<td>Seung Choul Yang</td>
</tr>
<tr>
<td>122</td>
<td>Cryoablation of Renal Masses as a Salvage Technique in Patients with a Solitary Kidney: Intermediate-Term Results</td>
<td>Ravi Munver</td>
</tr>
<tr>
<td>123</td>
<td>Effects of Resectoscope Loop Manipulation</td>
<td>Rahuldev Bhalla</td>
</tr>
<tr>
<td>124</td>
<td>Nonlinear Analysis of Kinematic Chains with Impacts</td>
<td>Dan Marghitu</td>
</tr>
<tr>
<td>125</td>
<td>Novel Technique of Knotless Hemostatic Parenchymal Repair During Laparoscopic Partial Nephrectomy</td>
<td>Alexandria Lynch</td>
</tr>
<tr>
<td>126</td>
<td>A Comparison of Laparoscopic, Video-Assisted Minilaparotomy, Open Radical Nephrectomy for Renal Cell Carcinoma</td>
<td>Koon Ho Rha</td>
</tr>
<tr>
<td>127</td>
<td>Minimal Tumour on Prostate Biopsy - the Tip of the Iceberg?</td>
<td>Faiyaz Kapasi</td>
</tr>
<tr>
<td>No.</td>
<td>Title</td>
<td>Presenting Author</td>
</tr>
<tr>
<td>-----</td>
<td>----------------------------------------------------------------------</td>
<td>-----------------------------------</td>
</tr>
<tr>
<td>201</td>
<td>Best Paper Award MRI-Guided Robot for Automated Prostate Brachytherapy</td>
<td>Michael Muntener</td>
</tr>
<tr>
<td>202</td>
<td>Salvage Treatment Of Prostate Cancer Recurrence (RPCA) By High Intensity Focused Ultrasound (HIFU)</td>
<td>Christian Chaussy</td>
</tr>
<tr>
<td>203</td>
<td>Towards an Intra-Operative Assessment Of the Degree Of Calcification During Automated Surgery</td>
<td>Bert Willaert</td>
</tr>
<tr>
<td>204</td>
<td>Prostate Cancer Treatment With High Intensity Focused Ultrasound (HIFU) By Ablatherm® With Real Time Integrated Imaging</td>
<td>Stefan Thüroff</td>
</tr>
<tr>
<td>205</td>
<td>Best Paper Award Computer Assisted S3 Nerve Root Neuromodulation</td>
<td>Pierre Mozer</td>
</tr>
<tr>
<td>206</td>
<td>Registration Algorithms for Robotic Mri-Guidedprostate Brachytherapy</td>
<td>Alexandru Patriciu</td>
</tr>
<tr>
<td>207</td>
<td>10 Years High Intensity Focused Ultrasound (HIFU) As Local Treatment Of Prostate Cancer: Profile Of Side Effects</td>
<td>Christian Chaussy</td>
</tr>
<tr>
<td>209</td>
<td>Biogluce® Presenting As Radiographic Emphysematous Pyelonephritis Following Laparoscopic Partial Nephrectomy</td>
<td>Gary Chien</td>
</tr>
<tr>
<td>210</td>
<td>Niris Optical Coherence Tomography System: Application In Urology and Robotic-Assisted Surgery</td>
<td>Felix Feldchtein</td>
</tr>
<tr>
<td>211</td>
<td>Histotripsy Of the Prostate: Feasibility Of Non-Invasive Cavitational Ultrasound Tissue Ablation</td>
<td>Kathleen Kieran</td>
</tr>
<tr>
<td>212</td>
<td>3D Evaluation Of Kidney Movement During Respiration Using 2.5D Ultrasound</td>
<td>Pierre Mozer</td>
</tr>
<tr>
<td>Session</td>
<td>Title</td>
<td>Presenter</td>
</tr>
<tr>
<td>---------</td>
<td>----------------------------------------------------------------------</td>
<td>----------------</td>
</tr>
<tr>
<td>213</td>
<td>Computer Assisted Intrarenal Access By CT and Ultrasound Image Fusion</td>
<td>Pierre Mozer</td>
</tr>
<tr>
<td>214</td>
<td>Digital Video Archival and Tele-Retrival (Div-Art) for Robotic Surgery</td>
<td>Alok Shrivastava</td>
</tr>
<tr>
<td>215</td>
<td>A 4-In-1 Silicone Training Aid for Practicing Laparoscopic Skills and Tasks</td>
<td>Corollos Abdelshehid</td>
</tr>
<tr>
<td>216</td>
<td>The Learning Curve for Robotic-Assisted Laparoscopic Radical Prostatectomy: A Multi-Institutional Experience of Laparoscopic and Oncologic Trained Urologists</td>
<td>Ravi Munver</td>
</tr>
<tr>
<td>217</td>
<td>High Intensity Focused Ultrasound (HIFU) As Primary Interventional Treatment Of Localized Prostate Cancer – Early Outcome and Morbidity</td>
<td>Dietrich Pfeiffer</td>
</tr>
<tr>
<td>218</td>
<td>Four-Arm daVinci™ Surgical System for Extraperitoneal Laparoscopic Robotic Prostatectomies</td>
<td>Mutahar Ahmed</td>
</tr>
<tr>
<td>219</td>
<td>Initial Experience Of Real-Time Transrectal Ultrasonography During Minilaparotomy Retropubic Radical Prostatectomy</td>
<td>Koji Okihara</td>
</tr>
<tr>
<td>220</td>
<td>The Impact Of Robotic Technology On 5-Year Radical Prostatectomy Practice Patterns at the First Institution With 3 daVinci™ Surgical Systems</td>
<td>Ravi Munver</td>
</tr>
<tr>
<td>221</td>
<td>Retrograde Intravesical Reconstructive Surgery (RIVRS): New Technique for Endoscopic Management Of Lower Ureter In Upper Tract TCC and Partial Bladder Resection and Primary Reconstruction</td>
<td>Mahesh Desai</td>
</tr>
<tr>
<td>222</td>
<td>Evaluation Of the Benique Sound, A Unique Device To Assist Urethrovessical anastomosis During Laparoscopic Radical Prostatectomy</td>
<td>Alexandria Lynch</td>
</tr>
<tr>
<td>223</td>
<td>Laparoscopic Radical Cystectomy: Early Oncological Outcome</td>
<td>Ismail Saad</td>
</tr>
</tbody>
</table>
ABSTRACT 101

EVALUATION OF NOVEL RENAL BIPOLAR RESECTION MORCELLATION TECHNIQUE

Franzo Marruffo, Gregory W Hruby, Sean Collins, Evren Durak, and Jaime Landman

Introduction: The elimination of the electrical morcellator from clinical use has left surgeons with manual morcellation as the only available modality for minimally invasive solid organ removal after surgery. As such, we compared renal morcellation using a bipolar resectoscope with standard manual morcellation in an *ex vivo* renal model.

Methods: A simulated abdominal wall was created through which a 12 mm trocar defect was created. In each case, a porcine kidney was placed within a LapSac and the open end was brought through the 12-mm trocar defect. In the control group, 10 kidneys were morcellated manually with ring forceps. In the study group, 10 kidneys were morcellated with a bipolar resectoscope. Intact kidney weight, morcellation time, LapSac integrity, and the size and weight of renal fragments were recorded.

Results: The mean kidney weight for standard morcellation and bipolar resection groups was equivalent at 159 and 141.5 grams respectively (p= 0.20). In both groups, there were two populations of renal fragments; larger and smaller fragments. The average weight of the small morcelled fragments in standard morcellation and bipolar resection groups were 4.3 and 2.2 grams respectively (p<0.01). For the standard morcellation and bipolar resectoscope group the average weight of the larger pieces was 22.6 and 22.0 grams, respectively (p=0.44). In the standard morcellation group, the average morcellation time was 6.9 minutes, and in bipolar resection morcellation group the morcellation time was 19.9 min (p<0.01). In the standard morcellation group, the amount of tissue resected per minute was 24.5 g/min versus 7.3 g/min bipolar resection morcellation group (p<0.01). LapSac integrity was confirmed in all resectoscope cases, but 1 LapSac was perforated in the control group. Microscopic evaluation of the perforated LapSac revealed that the rupture resulted from mechanical, and not thermal, damage.

Conclusions: Preliminary laboratory data demonstrates that renal morcellation using a bipolar resectoscope is feasible, but is slower than manual morcellation, and results in smaller fragments. Design modifications may increase the speed of bipolar resection morcellation.
ABSTRACT 102

AN IN-VIVO EVALUATION OF FLOW CHARACTERISTICS OF A NOVEL METAL URETERIC STENT

Sarah D. Blaschko, Leslie A. Deane, Alfred Krebs, Farhan Khan, James F. Borin, Alex C. Nguyen, Corollos S. Abdelshehid, Elspeth M. McDougall and Ralph V. Clayman
Department of Urology, University of California, Irvine

Introduction: To characterize the flow of a novel metal ureteric stent (Resonance stent, Cook Urological Inc., Spencer, IN) composed of a nickel-cobalt-chromium-molybdenum alloy and compare it to a standard 6 F ureteral stent.

Methods: Six 6 French Resonance stents and six 6 F standard Black Beauty ureteral stents (Cook Urological, Spencer IN) were placed into six Yucatan Minipigs with each pig serving as its own control. After placement, flow assessment was performed on all of the stents via a nephrostomy tube delivering a standard rate of normal saline at 35 cm H2O. Flow studies were performed on the standard stents to assess extraluminal (i.e. lumen of stent occluded with a guidewire), intraluminal (i.e. ureter secured to stent with a constricting suture), and combined (i.e. open lumen without constricting suture) flow. In the Resonance stent, only combined and intraluminal flow could be addressed, since there is no access to the lumen of this stent.

Results: Interestingly, intraluminal flow was much greater in the Resonance stent than combined flow with mean values of 5.15 mL/min. and 2.50 mL/min., respectively (p-value 0.057, SD 7.73). Intraluminal flow was similar to combined flow in the 6 F standard stent with mean values of 7.34 mL/min. and 7.30 mL/min., respectively (p-value 0.88, SD 1.76). The 6 F standard stent had statistically significant greater flow than the Resonance stent for combined flow (p= 0.023) but not for intraluminal flow (p = 0.247) Of note, while it was possible to completely occlude the 6F standard stent with a ureteral ligature (i.e. no guidewire placed in the lumen), it was not possible to occlude the Resonance stent regardless of how tightly the suture was tied.

Conclusion: Given its resistance to compression and its superior flow characteristics in the presence of extrinsic compression, it would appear that the Resonance stent might have its greatest use among those patients with malignant extrinsic ureteral obstruction. Clinical data pend.
ABSTRACT 103

CONTINUOUS FLOW FLEXIBLE CYSTOURETHROSCOPY: FEASIBILITY USING AN EVERTING URETHRAL ACCESS SHEATH

Bela S. Denes, MD, FACS, University of California, Irvine; Irvine, CA
Kovács Gábor, MD, National Health Center, Dept of Andrology and Urology, Budapest, Hungary
Varga József, MD, Uzsoki Hospital, Budapest, Hungary

Introduction:
Flexible cystourethroscopy is the procedure of choice for diagnostic examination of the lower urinary tract particularly in an ambulatory setting. However it’s applicability for more complex operative procedures including biopsy, fulguration is limited due to inability to effectively irrigate, drain or decompress the bladder which can compromise vision as well as impact patient safety and tolerability. The development of a readily adaptable continuous flow system to use with flexible cystoscopy would expand the realm of flexible cystoscopy and be expected to transition some operative procedures to the office setting. The objective of this study was to assess the capacity of a specifically designed urethral introducer sheath to facilitate continuous flow with a standard flexible cystoscope.

Methods: An artificial bladder was constructed from acrylic with a volume of 432 cc and a diameter of 12 cm, mimicking a distended bladder under anesthesia. A 17 Fr flexible cystoscope (ACMI) was advanced into the artificial bladder via urethral introducer sheaths (Cystoglide, PercSys, Inc, Mountain View, CA) with internal diameters of 19 Fr and 17 Fr. Inflow of water via the flexible cystoscope was standardized at a height of 90 cm above the bladder using standard tubing. The tip of the flexible cystoscope was articulated in three positions—no (0) deflection, maximum upward (+) deflection, and maximum downward (-) deflection. Outflow via the side port of the urethral introducer sheath was by gravity and measured in a graduated cylinder and compared to the outflow through the irrigating channel of the cystoscope.

Results: The outflow of the 17 Fr cystoscope itself was 145 mL/min (2.4ml/sec) in 0 deflection and 140 mL/min in both + and – deflections. When placed via the 19 Fr internal diameter introducer sheath, the outflow was 140 mL/min with the cystoscope with 0 deflection and 130 mL/min with both + and – deflections. Advancing a 17 Fr cystoscope via the introducer sheath with a nominal internal diameter of 17 Fr resulted in slowed outflow rates: 35 mL/min, 20 mL/min, and 10 mL/min for cystoscope positions 0, +, and – deflection, respectively. retracting the cystoscope 5 cm into the 17 Fr ID introducer sheath increased outflow rates to 70 mL/min and 80 mL/min in cystoscope positions of 0 and + deflection, respectively. Retracting the cystoscope 5 cm from the tip of a 19 Fr internal diameter sheath did not affect outflow rates.

Conclusion: A continuous flow configuration was established when a 17 Fr cystourethroscope was advanced into an artificial bladder via a urethral introducer sheath (internal diameter 19 Fr). Measured flow rates appear adequate to allow visualization for procedures typically performed with rigid cystoscopes or resectoscopes. The ease of advancement of the introducer sheath without anesthesia suggests that it may be possible to transition operative procedures that benefit from continuous flow into the office setting. This is the first description of a functional continuous flow flexible cystoscopy system that allows for a separate outflow channel thus allowing improved visualization, uninterrupted bladder irrigation and decompression.
ABSTRACT 104

A COMPARISON OF LAPAROSCOPIC, VIDEO-ASSISTED MINILAPAROTOMY, OPEN PARTIAL NEPHRECTOMY FOR THE SMALL EXOPHYTIC RENAL MASS

Yong Seong Lee¹, Woong Kyu Han, Kang Su Cho, Seung Hoon Lee, Sung Yong Cho, Seung Choul Yang, Koon Ho Rha
Department of Urology, Urologic Science Institute, Yonsei University College of Medicine
¹Department of Urology, Hallym University College of Medicine, Seoul, Korea

Introduction and Objective: Nephron-sparing surgery has emerged as the treatment of choice for the incidentally detected small renal mass, especially those less than 4 cm in size. We compared the surgical outcomes of 2 forms of minimally invasive surgery, laparoscopic partial nephrectomy (LPN) and video-assisted minilaparotomy partial nephrectomy (VAMS-PN), with conventional open partial nephrectomy of these lesions.

Methods: Between May 2004 and July 2005, data from patients who underwent LPN (n=13), VAMS-PN (n=20), and open (n=22) partial nephrectomy were reviewed. LPN was performed transperitoneal approach. VAMS-PN was performed extraperitoneally by using a specially designed retractor system such as piercing abdominal wall elevator and telescope connected to a video monitor system.

Results: There were no significant differences among three groups undergoing LPN, VAMS-PN, and open partial nephrectomy in terms of mean operative time (145.8 vs 140 vs 130.5 minutes, respectively). 2 forms minimally invasive procedures (LPN and VAMS-PN groups) were no differences in mean hospital stay and time to full ambulation, but there was significant different from those of the open group (p<0.05) (Table 1). In all groups pathologic results were renal cell carcinoma, and surgical margins were negative. Complications included 1 transfusion in the VAMS-PN group and open group, respectively.

Conclusions: Compared to open partial nephrectomy, LPN and VAMS-PN were associated with equivalent surgical outcomes, less morbidity, short return to usual activity, good cosmesis. We believe this minimally invasive surgeries can be applied broadly in the treatment of small renal mass.

Table 1: Operative and postoperative data of patients undergoing LPN, VAMS-PN and OPN LPN: Laparoscopic partial nephrectomy, OPN: open partial nephrectomy, VAMS-PN: video-assisted partial nephrectomy through minilaparotomy

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<thead>
<tr>
<th></th>
<th>LPN</th>
<th>VAMS-PN</th>
<th>OPN</th>
<th>p value</th>
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</thead>
<tbody>
<tr>
<td>Mean total operative time (min)</td>
<td>145.8</td>
<td>140</td>
<td>130.5</td>
<td>&gt; 0.05</td>
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<tr>
<td>Mean estimated blood loss (ml)</td>
<td>215.4</td>
<td>156.5</td>
<td>180.9</td>
<td>&gt; 0.05</td>
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<tr>
<td>Mean warm ischemic time (min)</td>
<td>28.5</td>
<td>28.2</td>
<td>32.1</td>
<td>&lt; 0.05</td>
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<tr>
<td>Mean mass size (cm)</td>
<td>2.5</td>
<td>2.2</td>
<td>2.4</td>
<td></td>
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<tr>
<td>Mean hospital stay (day)</td>
<td>5.8</td>
<td>4.6</td>
<td>7.8</td>
<td>&lt; 0.05</td>
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<tr>
<td>Time to full ambulation (day)</td>
<td>1.2</td>
<td>1.31</td>
<td>3.3</td>
<td>&lt; 0.05</td>
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</tbody>
</table>
ABSTRACT 105

MRI-GUIDED CONFORMAL TRANSURETHRAL THERMAL THERAPY FOR PROSTATE DISEASE: IN-VIVO DEMONSTRATION IN A CANINE MODEL

Rajiv Chopra¹, Nicole Baker¹, Aaron Boyes¹, Vanessa Choy¹, Kee Tang¹, Seamus Teahan², Linda Sugar³, Masoom Haider⁴, Laurence Klotz², Michael Bronskill¹
1. Imaging Research, Sunnybrook and Women’s College Health Sciences Centre
2. Dept of Urology, Sunnybrook and Women’s College Health Sciences Centre
3. Dept of Pathology, Sunnybrook and Women’s College Health Sciences Centre
4. Dept of Radiology, Princess Margaret Hospital, University Health Network

Introduction: Our group is developing MRI-guided transurethral thermal therapy using high-intensity ultrasound energy as a minimally invasive treatment for localized prostate cancer. The objective of this study was to demonstrate the feasibility of this technology in a clinical setting, and to evaluate the capability to treat targeted regions accurately within the prostate gland.

Methods: Transurethral heating applicators were inserted to a desired location within the prostate gland in a canine model (n=6). Ultrasound energy was delivered to pre-defined angular sectors within the gland, while the temperature distribution was measured with MR thermometry continuously during treatment to evaluate the spatial heating pattern. After treatment, the prostate was removed, and vital staining and histology were performed in the plane of treatment to assess the precision of this therapy.

Results: Under MRI guidance, heating applicators could be positioned to within 1-2mm of the desired position in the prostate. Using MR thermometry, stable, quantitative measurements of the spatial heating pattern in the plane of rotation were made with a temporal resolution of 5 s, a spatial resolution of 1.5 x 1.5 mm (in-plane), and a temperature uncertainty of approximately 1°C. Heating was confined to the targeted angular sectors within the prostate, as verified by imaging, gross inspection, and histology. The margin extending from 100% cell kill to no significant damage was determined by histological analysis to be ≤ 3 mm in distance. This study demonstrated that thermal damage can be confined to targeted regions of the prostate with transurethral heating applicators and can be safely monitored by MR thermometry (Figure 1). This technology is a promising form of therapy for both primary and recurrent localized prostate disease.

Figure 1: Sample results from a single canine treatment in canine prostate gland, shown in left panel. The maximum temperature distribution was measured during treatment to indicate the region of treatment (middle panel). Subsequent vital staining with TTC (right panel) depicted the region of thermal damage within the prostate.
ABSTRACT 106

THE NEW GENERATION KOSIN UNIVERSAL PIGGY BACK IRRIGATION SYSTEM (UPBIS) ACHIEVES EQUIVALENT URETEROSCOPIC IRRIGANT FLOW RATES WITH SUPERIOR ERGONOMIC HAND CONTROL

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New Hyde Park, New York USA

Introduction: Pressure irrigation is often needed to maintain adequate visualization during various ureteroscopic procedures. Increasing irrigant pressure gradients may be achieved by raising the height of the infused irrigant, inflating a pressure cuff around the irrigation bag, or utilizing a hand-pressure control system. We sought to evaluate if the Kosin Universal Piggy Back Irrigation System (UPBIS) (Figure 1) could achieve equivalent ureteroscopic irrigant flow rates to other available hand-pressure control systems or offer an ergonomic advantage.

Materials and Methods: Irrigation flow rates (L/hr) of three ureteroscopic hand-pressure irrigation systems (Kosin UPBIS, Boston Scientific SAPS, and Path Finder) were measured through a 2F ureteroscope ex-vivo. Irrigation flow rates were measured at an irrigant (0.9% normal saline) height of 4 ft. and at 4 ft. when 150 mmHg were applied. Three urologists were asked their opinion on the ergonomic advantage(s), if any, of the Kosin UPBIS when used en-vivo during ureteroscopic holmium laser ablation of upper tract transitional cell carcinoma (UTTCC).

Results: There were no differences in average ureteroscopic flow rates (L/hr) between the Kosin UPBIS, Boston Scientific SAPS, and Path Finder devices at irrigation height of 4 ft (0.81, 0.86, 0.87, respectively) or at 4 ft with 150mmHg of hand pressure (2.32, 2.34, 2.27, respectively) (Figure 2). Urologists felt the Kosin UPBIS could be easily utilized during laser UTTCC resection without the help of an assistant. Minimal hand force was needed to generate adequate irrigation pressure, contrary to what was experienced when generating irrigation pressure with the Pathfinder device.

Conclusions: The Kosin UPBIS ureteroscopic irrigation system achieves equivalent flow rates to other available hand pressure irrigation systems. Added advantages of this new generation hand pressure irrigation device include superior ergonomic hand control and maximizing hand working element organization without the need of a surgical assistant.

![Figure 1](image1.png)

![Figure 2](image2.png)
ABSTRACT 107

IN VITRO ANALYSIS OF LAPRA-TY CLIP STRENGTH

Corollos Abdelshehid BS, James Borin MD, Leandro Sala MD, Sheng-Tang Wu MD, Elspeth McDougall MD, Ralph V. Clayman MD

University of California, Irvine, Department of Urology, Orange, CA

**Introduction:** Lapra-Ty clips (Ethicon Surgical, Summerville, New Jersey) are a useful adjunct to laparoscopic surgery because they can obviate the need for intracorporeal knot-tying. The manufacturer recommends use with 3-0 and 4-0 Vicryl, but they have been used clinically with other types and sizes of suture. We investigated the slip force required to dislodge a Lapra-Ty clip from several different types of suture.

**Methods:** A Lapra-Ty clip was applied to a 7 cm segment of each of the following sutures: Vicryl (0, 2-0, 3-0, 4-0, 5-0); Monocryl (3-0, 4-0); Chromic Gut (3-0). The clip was held firmly in the jaws of a Chatillon® DFA-10 Digital Force Gauge (Ametek, Largo, Florida) while the free end of the suture was pulled taught with a needle driver until there was any evidence of slippage. The maximum force applied at the time of slippage was recorded.

**Results:** Chromic gut required the highest amount of force to induce slippage (4.31 lbs, p<0.0001 compared to all other sutures). 3-0 (2.92 lbs) and 4-0 (2.52 lbs) Monocryl were statistically equivalent to each other, but superior to all the Vicryl sutures (p<0.0001). For the Vicryl sutures, 0, 2-0, and 3-0 required equivalent amounts of force to induce slippage (1.69, 1.49, 1.43 lbs) but were superior to 4-0 (1.12 lbs) and 5-0 (0.80 lbs), p<0.001.

**Conclusion:** 3-0 Chromic Gut and 3-0 and 4-0 Monocryl were able to withstand a higher amount of force than Vicryl suture before slipping through a Lapra-Ty clip. Although the manufacturer recommends Lapra-Ty clips for use with 3-0 and 4-0 vicryl suture, our in vitro model suggests that they may be used with other types and sizes of suture.
ABSTRACTS – Session 1

ABSTRACT 108

STUDY OF CALCULUS FRAGMENTATION AND RETROPULSION AS A FUNCTION OF HO:YAG LASER PULSE DURATION

Hyun Wook Kang1, Joel M.H. Teichman2, Jasen Petersen3, Junghwan Oh1, Jihoon Kim1, A.J. Welch1
1Department of Biomedical Engineering, the University of Texas at Austin
2Division of Urology, St. Paul’s Hospital, University of British Columbia, Vancouver, B.C., Canada,
3Convergent Laser Technologies, Alameda, CA

Introduction: Stone retropulsion during holmium:YAG lithotripsy increases with optical fiber diameter and pulse energy. In this study, we investigated how optical pulse duration affects stone fragmentation and retropulsion.

Methods: A clinical Ho:YAG laser with dual pulse durations was employed to fragment stones and to evaluate retropulsion. All laser lithotripsy events were performed using single pulse ablation. At a given pulse energy, optical pulse was divided into two discrete durations (figure at right): short pulse ($\tau_p: 120 \sim 190$ µsec at FWHM) and long pulse ($\tau_p: 210 \sim 350$ µsec at FWHM). Plaster of Paris calculus phantoms were ablated at different energy levels using various optical fibers (273, 365, 550 µm in core size). The dynamics of the recoil action of a calculus phantom were monitored using a high-speed camera and the laser-induced craters were evaluated with optical coherent tomography. Vapor bubble formation and collapse were recorded with a fast flash photography setup, and acoustic transients were measured with a needle hydrophone.

Results: Short pulse duration induced more stone retropulsion than long pulse did at any given pulse energy. Ablation volumes did not differ across fiber diameter for the short pulse ablation. Ablation volumes increased as fiber diameter increased for the longer pulse ablation. Regardless of pulse duration, higher pulse energy and larger diameter fibers resulted in larger ablation volume and retropulsion. When retropulsion distance was normalized by ablation volume, retropulsion per unit volume was consistently 30% greater for the shorter pulse duration ablation (figure at right). Fast flash photography showed that for short pulse duration that more rapid bubble expansion was observed (bottom center figures) and higher magnitude of the collapse pressure wave was measured (bottom right figure).

Conclusion: Short pulse duration induced more stone retropulsion normalized with ablation volume. The longer pulse duration yields smaller collapse pressures which could minimize retropulsion during laser lithotripsy. Our results corroborate a recently published study of retropulsion using a multiple pulse model.
ABSTRACT 109

EVALUATION OF LAPAROSCOPIC VESSEL SEALING SYSTEMS IN A PORCINE MODEL: HARMONIC ACE, HARMONIC LCS-C5, LIGASURE 5, AND TRISECTOR

Greg Hruby*, Franzo Marruffo, Evern Durak, Sean Collins, Phil Pierorazio and Jaime Landman

Introduction and Objective: A number of vessel sealing systems (VSS) have become clinically available for application during laparoscopic procedures. We assessed presently available systems for vessel sealing.

Methods: A total of 24 domestic pigs were divided into four groups for the evaluation of the four VSS: The Harmonic ACE, and LCS-C5 (Ethicon, Cincinnati, Ohio), the Ligasure 5 (Valley Lab, Boulder, CO), and the Trisector (ACMI-Gyrus, Maple Grove, MN). A midline abdominal incision was made from xiphoid process to the pubic symphysis and both arteries and veins were dissected from above the renal vasculature down just past the bifurcation of the femoral vessels. Once the vasculature was completely dissected and exposed a VSS was used to seal all vessels starting with the femoral arteries and veins, continuing to the mesenteric vasculature, the renal vessels and finally the great vessels. Vessel size, transection time, in vivo failures, bursting pressures, and seal failure as defined by pressure were recorded and analyzed for arteries and veins separately. ANOVA was used to determine differences between the groups. A Bonferroni correction was used to identify the specific cause of differences between these groups.

Results: Table 1 represents each instruments performance regarding transection time, in vivo failure rate, vessel bursting pressure, and seal failures defined by pressure. The Ligasure 5 VSS was superior to other systems tested with regards to bursting pressures, in vivo failures, and failures defined by pressure. The Harmonic Ace followed with regards to bursting pressures, in vivo failures, and failures defined by pressure. The Ace followed by the Harmonic LCS-C5 transected and sealed vessels the most quickly. The Trisector matched the LCS-C5 with respect to sealing larger vessels (5.1->7.0), but the LCS-C5 out performed the Trisector for smaller vessels (0-5mm).

Conclusions: The Ligasure 5 was superior to other devices tested regarding the ability to seal vessels up to 7 mm. The Harmonic Ace offers an efficient vessel sealing system with the consistent ability to seal vessels up to 5mm.
### Table 1a: Arteries

<table>
<thead>
<tr>
<th></th>
<th>Ace</th>
<th>LCS-C5</th>
<th>Trisector</th>
<th>Ligasure 5</th>
<th>Anova Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>0-3.0 mm Arteries</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transection time (sec)</td>
<td>3.4</td>
<td>3.8</td>
<td>5.3</td>
<td>4.1</td>
<td>p&lt;0.01</td>
</tr>
<tr>
<td>In Vivo Failure Rate</td>
<td>0%</td>
<td>0%</td>
<td>12%</td>
<td>0%</td>
<td>p&lt;0.01</td>
</tr>
<tr>
<td>Bursting Pressures (mmHg)</td>
<td>511.1</td>
<td>444.7</td>
<td>337.6</td>
<td>569.4</td>
<td>p&lt;0.01</td>
</tr>
<tr>
<td>Bursting Failures*</td>
<td>5%</td>
<td>34%</td>
<td>41%</td>
<td>0%</td>
<td>p&lt;0.01</td>
</tr>
<tr>
<td><strong>3.1-5.0 mm Arteries</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transection time (sec)</td>
<td>4.6</td>
<td>4.8</td>
<td>7.3</td>
<td>5.7</td>
<td>p&lt;0.01</td>
</tr>
<tr>
<td>In Vivo Failure Rate</td>
<td>0%</td>
<td>8%</td>
<td>24%</td>
<td>0%</td>
<td>p&lt;0.01</td>
</tr>
<tr>
<td>Bursting Pressures (mmHg)</td>
<td>421.1</td>
<td>338.0</td>
<td>317.4</td>
<td>557.8</td>
<td>p&lt;0.01</td>
</tr>
<tr>
<td>Bursting Failures*</td>
<td>16%</td>
<td>47%</td>
<td>53%</td>
<td>0%</td>
<td>p&lt;0.01</td>
</tr>
<tr>
<td><strong>5.1-7.0 mm Arteries</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transection time (sec)</td>
<td>5.4</td>
<td>6.6</td>
<td>Na</td>
<td>8.0</td>
<td>p&lt;0.01</td>
</tr>
<tr>
<td>In Vivo Failure Rate</td>
<td>7%</td>
<td>50%</td>
<td>50%</td>
<td>0%</td>
<td>p&lt;0.01</td>
</tr>
<tr>
<td>Bursting Pressures (mmHg)</td>
<td>372.2</td>
<td>142.8</td>
<td>177.5</td>
<td>533.7</td>
<td>p&lt;0.01</td>
</tr>
<tr>
<td>Bursting Failures*</td>
<td>17%</td>
<td>83%</td>
<td>50%</td>
<td>0%</td>
<td>p&lt;0.01</td>
</tr>
<tr>
<td><strong>&gt;7.1 mm Arteries</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transection time (sec)</td>
<td>8.3</td>
<td>8.6</td>
<td>11.0</td>
<td>9.7</td>
<td>p=0.03</td>
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<tr>
<td>In Vivo Failure Rate</td>
<td>100%</td>
<td>86%</td>
<td>50%</td>
<td>85%</td>
<td>p=0.57</td>
</tr>
<tr>
<td>Bursting Pressures (mmHg)</td>
<td>0.0</td>
<td>21.4</td>
<td>50.0</td>
<td>83.3</td>
<td>p=0.77</td>
</tr>
<tr>
<td>Bursting Failures*</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>85%</td>
<td>p=0.64</td>
</tr>
</tbody>
</table>

*Burst failure if vessel burst below or equal to 300 mmHg

### Table 1b: Veins

<table>
<thead>
<tr>
<th></th>
<th>Ace</th>
<th>LCS-C5</th>
<th>Trisector</th>
<th>Ligasure 5</th>
<th>Anova Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>0-3.0 mm Veins</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transection time (sec)</td>
<td>2.8</td>
<td>4.3</td>
<td>3.3</td>
<td>4.1</td>
<td>p&lt;0.01</td>
</tr>
<tr>
<td>In Vivo Failure Rate</td>
<td>0%</td>
<td>0%</td>
<td>5%</td>
<td>0%</td>
<td>p=0.28</td>
</tr>
<tr>
<td>Bursting Pressures (mmHg)</td>
<td>228.4</td>
<td>237.6</td>
<td>250.6</td>
<td>432.0</td>
<td>P&lt;0.01</td>
</tr>
<tr>
<td>Bursting Failures*</td>
<td>0%</td>
<td>0%</td>
<td>5%</td>
<td>0%</td>
<td>p=0.28</td>
</tr>
<tr>
<td><strong>3.1-5.0 mm Veins</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transection time (sec)</td>
<td>4.0</td>
<td>5.6</td>
<td>5.5</td>
<td>5.4</td>
<td>p&lt;0.01</td>
</tr>
<tr>
<td>In Vivo Failure Rate</td>
<td>0%</td>
<td>0%</td>
<td>7%</td>
<td>0%</td>
<td>p=0.57</td>
</tr>
<tr>
<td>Bursting Pressures (mmHg)</td>
<td>141.8</td>
<td>236.2</td>
<td>239.3</td>
<td>360.0</td>
<td>p&lt;0.01</td>
</tr>
<tr>
<td>Bursting Failures*</td>
<td>0%</td>
<td>0%</td>
<td>7%</td>
<td>0%</td>
<td>p=0.57</td>
</tr>
<tr>
<td><strong>5.1-7.0 mm Veins</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transection time (sec)</td>
<td>5.0</td>
<td>6.6</td>
<td>NA</td>
<td>6.3</td>
<td>p=0.24</td>
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<tr>
<td>In Vivo Failure Rate</td>
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<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>na</td>
</tr>
<tr>
<td>Bursting Pressures (mmHg)</td>
<td>250.0</td>
<td>0.0</td>
<td>217.0</td>
<td>319.7</td>
<td>p=0.66</td>
</tr>
<tr>
<td>Bursting Failures*</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>Na</td>
</tr>
<tr>
<td><strong>&gt;7.1 mm Veins</strong></td>
<td></td>
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<tr>
<td>Transection time (sec)</td>
<td>5.9</td>
<td>6.0</td>
<td>7.5</td>
<td>7.3</td>
<td>p&lt;0.01</td>
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<tr>
<td>In Vivo Failure Rate</td>
<td>9%</td>
<td>14%</td>
<td>50%</td>
<td>14%</td>
<td>p=0.30</td>
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<tr>
<td>Bursting Pressures (mmHg)</td>
<td>101.2</td>
<td>200.2</td>
<td>35.8</td>
<td>96.7</td>
<td>p&lt;0.01</td>
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<tr>
<td>Bursting Failures*</td>
<td>18%</td>
<td>14%</td>
<td>50%</td>
<td>14%</td>
<td>p&lt;0.01</td>
</tr>
</tbody>
</table>

*Burst failure if vessel burst below or equal to 50 mmHg
ABSTRACTS – Session 1

ABSTRACT 110

DIRECT VISUALIZATION OF CORTICAL PERITUBULAR CAPILLARY OF KIDNEY USING A MAGNIFYING ENDSCOPY

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The Department of Urology, Nagoya University School of Medicine, Nagoya, Japan

Introduction and Objective: We developed a direct imaging system of renal microcirculation by a magnifying endoscopy that enables visualization of the movement of erythrocyte in glomerular and cortical peritubular capillary(CPC). It is said that renal micro- hemodynamics and function were affected during CO2 pneumoperitoneum during laparoscopic surgeries. We examined the renal hemodynamics during CO2 pneumoperitoneum by using our direct imaging system.

Methods: Renal CPC were visualized with a needle-lens probe, charge-couple device video microscope with a tip diameter of 5 mm. The probe had a magnification of ×520, depth of field less than 60 μm, and spatial resolution of 0.86 μm, which permitted identification of individual erythrocytes. The probe was accompanied with the optical fibers transmitting light from a xenon AC 100-V light source. Video signals were digitized with an analog-to-digital converter and fed into a digital videocassette recorder(DV-CAM, Sony Co., Tokyo, Japan) interfaced with a computer. The device(Korea Touch Scope, Model 03-1) used in this study(available from Krea Seiko Co.,Ltd, Tokyo, Japan) has been improved for the application to laparoscopic surgery from the NPVM prototype reported in 1993 by us. Peritubular capillary blood flow of the pig kidneys was recorded with this laparoscopic microscope.

Results: Peritubular capillary blood flow decreased as the pneumoperitoneum pressure increased. When the pneumoperitoneum pressure was 25mmHg, we found that over 90% of the erythrocyte velocity of the CPC were non-flow.

<table>
<thead>
<tr>
<th>Pressure (mmHg)</th>
<th>0mmHg</th>
<th>5mmHg</th>
<th>10mmHg</th>
<th>15mmHg</th>
<th>20mmHg</th>
<th>25mmHg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Erythrocyte velocity (mm/sec)</td>
<td>0.24±0.09</td>
<td>0.24±0.10</td>
<td>0.21±0.06</td>
<td>0.10±0.02</td>
<td>0.08±0.02</td>
<td>0.00±0.004</td>
</tr>
</tbody>
</table>

Conclusion: A high magnifying micro-endoscopy was useful in evaluating the renal microcirculation in the laparoscopic surgery.
ABSTRACTS – Session 1

ABSTRACT 111

FORCES GENERATED WHILE TRAVERSING A 15 FRENCH URETHRAL STRicture: A COMPARISON BETWEEN 17 AND 19 FRENCH RIGID CYSTOSCOPES AND A 23 FRENCH EVERTING INTRODUCER SHEATH

Kristina Williams, Sam Bhayani MD
Division of Urology, Washington University School of Medicine, St. Louis, MO

Introduction: Advancing a rigid cystoscope in patients with a urethral stricture can be challenging and the force applied to advance the instrument, in combination with possible scope removals and re-entries, subject the urethra and stricture to stress. A novel urethral introducer facilitates dilation of the urethra to 23 French with the single advancement of an everting sheath. This study compared the force required to advance a 23 Fr everting device to that of 17 and 19 Fr rigid cystoscopes through a model of a urethral stricture.

Methods: A 1cm long artificial stricture (15 Fr) was created in a silicone model. The peak axial forces generated from five advancements of a 23 Fr everting introducer sheath (CystoGlide; Percutaneous Systems, Mountain View, CA), a 17 Fr, or a 19 Fr rigid cystoscope (Karl Storz 27026) through the 15 Fr stricture were measured with a Chatillon digital force gauge mounted on a motorized platform. In addition, the force required to advance a 17 Fr rigid cystoscope through the lumen of an introducer sheath previously placed through the 15 Fr stricture was measured. The mean forces (in Newtons) were analyzed with the Student’s t-test for significance.

Results: The mean peak force for the unlubricated 23 French everting introducer sheaths was 10.6 N. The mean peak force for the 17 Fr rigid cystoscope traversing the 15 Fr stricture was 8.4 N when lubricated and 13.8 N without lubrication, while the mean peak force for the 19 Fr rigid cystoscope was 12.0 N when lubricated and 19.6 N without lubrication. The mean forces to cross the 15 Fr stricture were significantly different (p<.01) between the two rigid cystoscopes but the force of the unlubicated 23 French introducer sheath was not significantly different when compared to either cystoscope. Advancement of the 17 Fr rigid cystoscope through the lumen of the introducer sheath required less than half the force (3.5 N) than advancing the 17 Fr cystoscope was through the stricture alone (8.4 N), a difference that was statistically significant (p<.01).

Conclusion: While further clinical work is needed to determine the efficacy of this device design on the treatment of strictures, the force generated traversing a 15Fr stricture by the 23 Fr everting introducer sheath is comparable to the force created by a 17 Fr cystoscope, despite the sheath’s larger diameter. The use of the everting introducer provides the additional advantage of reducing the potential for injury or irritation to the urothelium since any contact producing movement or abrasion will be against the inner lumen of the introducer sheath and not the tissue.
ABSTRACT 112

BLADDER NECK INCISION IN OUPATIENT SETTING. A FEASIBLE PROCEDURE USING REVOLIX 2 MICRON CW-LASER?

Herrmann TRW\textsuperscript{1}, Bach T\textsuperscript{3}, Cellarius C, Teichmann HO\textsuperscript{2}, Burchardt M\textsuperscript{1}, Jonas U\textsuperscript{1}, Gross AJ\textsuperscript{3}

\textsuperscript{1}University Hospital Hannover MHH, Department of Urology, Hannover, Germany
\textsuperscript{2}LISA laser products OHG, Katlenburg-Lindau, Germany
\textsuperscript{3}Asklepios Klinik Barmbek, Department of Urology, Hamburg, Germany

Objective: Bladder neck incision (BNI) is a common, minimally invasive treatment option for bladder outletflow obstruction in men with bladder neck sclerosis following transurethral resection (TUR) of the prostate. The problem of recurrent sclerosis is well understood. We report on our initial experience of BNI with the RevoLix laser in an outpatient setting. This cw-laser enables cutting and simultaneous coagulation in perfused as well as avascular tissue. Therefore, by prevention of bleeding and hematoma further tissue scarring could be lessened.

Materials and Methods: A total of 14 patients were included in the trial. Medical history reported 2nd or 3rd recurrence of bladder neck sclerosis after transurethral resection of the prostate. Further characteristics were high grade obstruction type in uroflowmetry, poor stream and no residual urine. Laboratory findings were in normal range. BNI was performed using a laser 365 µm laser fibre (PercuFib) and 70W 2 micron cw-Laser (RevoLix, LISA laser products). Bladder neck sclerosis was incised in 5° and 7° lithotomy position. The assessed outcomes were operative time, catheter time and hospital time. AUA symptom score and quality of life index, and maximal urinary flow rates were measured at baseline and 2 months postoperatively. All patients received analgosedation, 4 days perioperative treatment with ciprofloxacin was administered.

Results: Mean operative time was 7 min (5 - 21 min). Catheterisation time was at mean 6.5 hours (6 – 7.5 hours), office hospitalisation time 8 hours (7.5 till 9 hours). Uroflowmetric assessment of complete deobstruction was performed after 2month by office urologist. The postoperative uroflow rate was 25ml/s (19 – 28ml/s). AUA-SS and Qol measured preoperatively were mean 22 (19-28) and 4 (3-5) respectively. Postoperatively AUA-SS and Qol improved to 8 (7-12) and 1 (1-2) respectively. Postoperative visual analog scale (VAS) pain score was low at mean 14 (12-20). No postoperative complications, recatheterization or rehospitalisation occured. After removal of the catheter no macrohematuria was reported.

Conclusion: BNI with Revolix cw-Laser is safe, rapid and feasible as outpatient procedure in patients after recurrent bladder neck sclerosis. Relief of obstruction was achieved in all patients. No postoperative reintervention was necessary. Perioperative pain was minimal (VAS). BNI using Revolix laser could be the procedure of choice in a health system with limited resources as an outpatient procedure.
INTERSTITIAL ULTRASOUND THERMAL THERAPY OF THE PROSTATE: AN ANALYTICAL STUDY

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²Urology Clinic of Cumberland, Western Maryland Health System, Cumberland, MD, USA

Introduction: Microwave and ultrasound energy sources are commonly used in minimally invasive thermal therapy for benign prostatic hyperplasia. Successful management of the therapy using such methods requires an accurate estimation of the thermal dosage. The purpose of this study is to (1) theoretically evaluate the thermal damage caused by interstitial ultrasound applicators for a range of thermal doses and (2) provide correlations between the treatment parameters and lesion shapes. These correlations are expected to be useful for predicting the extent of thermal damage.

Methods: Using an Alternating-direction implicit method, the Pennes bio-heat transfer equation is solved for interstitial ultrasound heating of the prostate. Internal and external cooling is applied to preserve the rectal lining and to control the temperatures within the tissue. Variables considered in this study are the input power, heating time, applicator geometry and position, and coolant rates and temperatures. Perfusion is incorporated into the model as a temperature-dependent variable. The extent of thermal coagulation is determined from the resulting temperature histories, using the existing experimental thermal damage data for prostatic tissue. The temperatures and damage contours calculated are validated using an Arrhenius analysis of the temperature and thermal-lesion data from the existing experimental results for canine prostate.

Results: The shape of the lesions calculated are in good agreement with those determined in the in-vivo experiments. Results indicate that the extent of the tissue damage can be well controlled by the applicator placement, directionality, power, application and cooling times, and the coolant temperature. Based on the numerical experiments performed for different combinations of the parameters, a set of correlations are developed for predicting the volume and shape of the lesions. Results from calculations for different combinations of the parameters are presented in terms of the transient temperature histories and radial and axial extent of the lesion shapes.

Conclusions: Interstitial applicators can yield significant thermal damage in the vicinity of the applicator. Correlations provided here will be useful in determining the parameter values that are needed to cause damage in a known volume of target tissue. Further analysis is required to compare the efficacy of interstitial heating with transurethral heating.
ABSTRACT 114

PROPHYLACTIC GELFOAM TO PREVENT BLEEDING AFTER PERCUTANEOUS RENAL CRYOABLATION IN A SWINE MODEL

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² Department of Urology, The James Buchanan Brady Urological Institute, Johns Hopkins Medical Institutions, Baltimore, MD.
³ Department of Radiology, Memorial Sloan-Kettering Cancer Center, New York, NY
⁴ Institute for Urology, North Shore-LIJ Health System, Long Island, New York, NY

Background and Purpose: Achieving hemostasis can be a challenge during percutaneous renal cryoablation (PRC). We used a porcine model to test the ability of gelfoam track injection to limit bleeding at the site of cryoprobe puncture.

Materials and Methods: Regarding animal care and use committee approval, a total of 9 swine (18 kidneys) underwent bilateral ultrasound-guided PRC with double freeze-thaw cycle protocol and 2.4 mm cryoprobe. The cryoablation location and protocol was applied identically to both kidneys in each pig, however, only one side received gelfoam injection through the coaxial sheath (3 mm) after cryoprobe removal. Acute blood loss was compared between the two groups. The kidneys treated with gelfoam were removed and grossly and histologically examined to identify the gelfoam at the puncture cryolesion.

Results: Gelfoam sides resulted in significantly less blood loss (mean 8.24 ± 4.68 mg ) compared to the control sides (mean 20.24 ± 8.14 mg), p = 0.001. Gross and histopathological results confirmed that the gelfoam was in the cryoablation puncture sides. Mean diameter of the cryoablation lesions at gelfoam and control side was 3.9 ±0.2 cm and 3.8 ± 0.4, respectively. The lesion was no statistically different between both sides.

Conclusion: The technique of percutaneous injection of gelfoam seems promising for the prophylaxis of hemorrhage after PRC.
ABSTRACT 115

TECHNIQUE FOR OPTIMIZING TISSUE YIELD FROM NEEDLE BIOPSY OF RENAL PARENCHYMA

Gregory Hruby, Rob Mitchell, Franzo Marruffo, Sean Collins, Phil Pierorazio, and Jaime Landman

Introduction and Objective: Increasing understanding of the biology of renal cortical neoplasms and increased utilization of renal ablative technologies has increased the importance of establishing histopathologic diagnoses by needle biopsy. We evaluated biopsy technique and available technologies to optimize the diagnostic yield of needle biopsy.

Methods: Eleven needle biopsy devices were evaluated including: Bard (Murray Hill, New Jersey) (Max-Core 18G and 20G, Monopty 16G and 18G, and Magnum 12G, 14G, 16G, 18G, and 20G); and Boston Scientific (Natick, MA) (Easy Core 18G and TruPath 18G). All biopsies were performed on live, anesthetized domestic pigs with normal blood pressure. Each device was tested by application of two different biopsy techniques. In group 1, the needle was fired just outside the target tissue. In group 2, the needle was fired after it was inserted into the target tissue. Ten biopsies were performed with each device. All core biopsy samples were fixed in 5% formalin and sent for standard histopathological evaluation. Tissue core evaluation included measurements of the tissue sample core length, width, the number of glomeruli captured, and the number of vessels present in each sample.

Results: A total of 220 biopsies were performed (110 in each group). No difference in biopsy specimen quality was seen between biopsy devices from different manufacturers. The differences in biopsy parameters between biopsy techniques are described in table 1. Table 2 and 3 list the differences in biopsy results with different size biopsy needles in groups 1 and 2.

<table>
<thead>
<tr>
<th>Table 1: Biopsy technique groups 1 &amp; 2</th>
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<tbody>
<tr>
<td>Group 1 (Fired outside tissue)</td>
</tr>
<tr>
<td>Tissue core Length</td>
</tr>
<tr>
<td>Tissue Core Width</td>
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<tr>
<td># glomeruli</td>
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<td># vessels</td>
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<th>Table 2: Group 1 (Fired outside tissue)</th>
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<td>16 guage</td>
</tr>
<tr>
<td>Tissue core Length</td>
</tr>
<tr>
<td>Tissue Core Width</td>
</tr>
<tr>
<td># glomeruli</td>
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<tr>
<td># vessels</td>
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<tr>
<th>Table 3: Group 2 (Fired inside tissue)</th>
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<tr>
<td></td>
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<tr>
<td>16 guage</td>
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<tr>
<td>Tissue core Length</td>
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<tr>
<td>Tissue Core Width</td>
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<tr>
<td># glomeruli</td>
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<tr>
<td># vessels</td>
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</table>

Conclusions: In this animal model, significantly improved quality of the needle biopsy specimen was obtained by using a larger caliber needle (16 guage) and by deployment of the needle outside of the target. Clinical correlation is in progress.
ABDOMINAL COMPRESSION BELT – AN EASY TOOL TO INCREASE EFFICACY OF ESWL

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Introduction: Efficacy and side effects of extracorporeal shockwave lithotripsy (ESWL) depend on percentage of shockwaves hitting the targeted stone. Stone movement, caused by deep abdominal respiration is most contraproductive for successful treatment. We perform ESWL since 15 years with an abdominal belt and sufficient analgesia, minimizing respiratory renal and upper ureteral movements.

Material and Methods: Every patient for ESWL is fixed with a 10 cm wide abdominal belt onto the lithotripsy treatment table (SIEMENS MODULARIS/MULTILINE). Because of the firm fixation of the patient, the respiratory excursions of kidney and upper/middle ureter decrease; thus a targeted stone remains better in shockwave focus. To document this effect, the maximal respiratory excursions with and without abdominal compression have been evaluated. Experiments with test stones under motorized movement in a waterbath were carried out, to investigate the influence of stone movements in respect to desintegration capacity. Patients comments and side effects have been recorded, the device and its fixing mode is presented.

Results: An abdominal compression in combination with a sufficient analgesia achieves flat respiratory excursions and reduce stone movements during ESWL significantly. Stone movements +/- 1 cm reduce the desintegration capacity to 60 % (+/- 2 cm to 30 %) in the experimental setup. In consequence, higher target stability increases efficacy of shockwave therapy and lowers ESWL associated side effects like hematoma and tissue damage. This simple device causes no significant costs nor side effects.

Conclusion: The abdominal belt is an elementary and cheap tool, to minimize respiratory movements of kidney and upper ureteric stones. Its use is obligatory in our department since more than one decade. Patients acceptance is high, no side effects are reported.
AUTOFLEX LASER APPLICATOR COMBINES EXCELLENT HANDLING AND VISIBILITY IN UROLOGICAL LASER SURGERY

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2Medical College of Hannover, Department of Urology, Hannover, Germany
3LISA laser products OHG, Katlenburg-Lindau, Germany

Introduction: Today we find a decreasing frequency of ESWL and a shift towards primary PCNL for kidney stone therapy. Furthermore, the use of laser applications in the lower urinary tract (e.g. bladder neck contractures, bladder stone lithotripsy, urethral strictures) is rising. Because of the growing number of laser applications in endodurology, we need a more controlled guidance of the laser fiber without compromising the endoscopic view.

We introduce the AutoFlex 360 self-bending steerable laser-applicator (Lisa laser products) as a solution to this problem in a variety of urological procedures.

Material and methods: We use the AutoFlex 360-5.1-860 steerable laser-applicator (specifications given below).

The laser fiber is inserted into the applicator up to a position approximately 2 mm distal from the end of the applicator. After tightening the fiber-fixation, the applicator can be inserted into the endoscope. By rotation of the threads at the handle, the inner pre-bend tube can be exposed until the bending reaches the wished angle.

<table>
<thead>
<tr>
<th></th>
<th>Overall length</th>
<th>Working length</th>
<th>Outer diameter</th>
<th>Inner diameter</th>
<th>Max. angle of emitted beam</th>
</tr>
</thead>
<tbody>
<tr>
<td>AutoFlex 360-5.1-860</td>
<td>50 cm</td>
<td>36 cm</td>
<td>5,1 F</td>
<td>2,7 F</td>
<td>90°</td>
</tr>
</tbody>
</table>

Results: The loaded AutoFlex device can be inserted into the working channel of the endoscope without a problem. By exposing the bended inner core, the laser fiber can be steered precisely to the target. The use of the AutoFlex device was possible in all tested settings (PCNL, bladder stone lithotripsy, therapy of bladder neck sclerosis). Particularly in PCNL, stone therapy of upper and middle pole stones through a lower pole access is more comfortable. The need to use flexible endoscopes through the Amplatz sheath is reduced, so that the risk of damaging the coating of flexible endoscopes at the Amplatz sheath vanishes. Using the self-bending device reduces the risk of infundibular lesion in PCNL and consecutive bleeding.

Conclusion: The AutoFlex laser applicator combines precise steering of the laser fibre with excellent visibility. The laser application becomes easier and the risk of collateral injuries of neighbouring tissue is reduced.
ABSTRACT 118

LAPAROSCOPIC MULTI-PURPOSE RETRACTABLE TISSUE DISSECTOR AND SUTURE PASSER

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Introduction and Objective: Depending on surgeon preference, various instruments and techniques are used to help mobilize, isolate, and present tissue during laparoscopic surgery. One instrument we have found extremely useful is a prototype instrument we have developed that performs as a tissue/vascular dissector and as a retractable suture passer for intracorporeal knot tying.

Methods: The laparoscopic retractable instrument was developed at our institution and is an improvement of a commercially available device. Like the commercially available device, the retractable dissecting tip of our stainless steel instrument allows for easy insertion into a 5mm working port. Once the instrument is inserted, the curved dissector aids in the mobilization, isolation, presentation, and control of tissue in an a-traumatic fashion. This is especially useful for dissection of tissue around and behind the renal hilum and for presentation of renal vessels during donor nephrectomies. Once the dissection is complete, a tie can be loaded by hand into the eye hole of the curved metal dissector. After the tie is loaded, the instrument is reinserted and deployed behind the vessel. A second instrument is then used to grab the tie and the laparoscopic suture passer retracted. This allows for the tie to loop behind the vessel in preparation for intracorporeal knot tying.

Results: Our instrument has been used in the porcine model and in the human during laparoscopic pyeloplasties, radical, partial, and donor nephrectomies. We have successfully dissected, isolated, and ligated the renal vein without any complications. Our device was particularly useful for tying large renal veins in preparation for clip application and for isolating lumbar vessels when there was inadequate space for clip or stapler use. Furthermore, for teaching and practicing intracorporeal tying, this instrument has been extremely useful whenever the ligation of ureters and gonadal vessels are necessary.

Conclusions: We have developed a laparoscopic non-disposable dissecting instrument that allows for the easy passage of suture behind vessels thus allowing for spontaneous intracorporeal vessel ligation. The instrument is particularly useful in the isolation and ligation of large renal veins and lumbar vessels. We are currently in the process of developing a retractable non-conducting tip so electro-cautery of presented tissue can be performed safely on the tip itself. We plan to have the instrument available for multi-institution use and evaluation in the near future.
APPLICATION OF URETERAL ACCESS SHEATH DURING URETEROSCOPY FOR UROLITHIASIS: AN ANALYSIS OF CLINICAL AND MECHANICAL OUTCOME

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²Department of Mechanical Engineering, University of Maryland, College Park, MD, USA

Introduction: Ureteral access sheaths have been utilized to reduce access time to upper urinary tract and facilitate instrument passage and stone extraction during ureteroscopy. There is, however, limited information on efficacy of these access sheaths in routine clinical setting. This study aims to analyze the outcome of application of different access sheaths during ureteroscopic management of urolithiasis.

Methods: Information on application of ureteral access sheaths of various makes in respect to ease of application, clinical and mechanical problems during ureteroscopic management of urolithiasis was collected prospectively. Clinical outcome of application was categorized in to normal positioning, suboptimal placement with and without associated significant external redundant sheath and failure to position. Underlying factors causing difficulty in placement of the access sheath were recorded. The choice of access sheath was selected in a non-random manner.

Results: 124 access sheaths – 76 Forte AXP (Applied Medical Inc.); 19 Navigator (Microvasive Boston Scientific Inc.) and 29 Aquaglide (Bard Inc.) – were utilized in 116 ureteroscopic procedures. Of 127 access sheath placements, “Normal Positioning” was accomplished in 106 placements (Forte AXP 65, Navigator 15 and Aquaglide 24), “Redundant Sheath” was observed in 14 (Forte AXP 9, Navigator 1 and Aquaglide 4) while there were 7 “failed placements” (Forte AXP 1, Microvasive 3 and Aquaglide 3). Placement of access sheath was significantly different (Chi Test) between Forte AXP versus Navigator (p=0.025) while such significant difference was not observed between Forte AXP and Bard and Navigator and Aquaglide group. Positioning difficulties were categorized as none 104(81.8%), tortuous/floppy ureter 14(11%), bony prominence 7(5.5%) and ureteral stenosis 2(1.5%). 3 (21.42%) of externally redundant sheaths had to be excised to facilitate intra renal ureteroscopic maneuvers. Access sheath compression and kinking was observed in 1 (7.1%). Stone impaction on “sheath shelf” within the sheath was noted in 1 (7.1%).

Conclusions: This study demonstrated Forte AXP Access Sheath with significantly less positioning difficulties than Navigator Access sheaths. Further analysis of access sheath characteristics is required to improve overall quality and effectiveness.
**ABSTRACT 120**

**IN-SITU ESWL OF URETERIC STONES: STILL A COMPETITIVE TREATMENT OPTION**

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**Introduction**: Urology offers a variety of different therapeutic options for the treatment of ureteric stones. ESWL-treatments of the last 10 years have been analyzed, to determine, whether ESWL is a competitive option for such patients.

**Material und Methods**: More than 10,000 ESWL-treatments were performed in our department with an electromagnetic SW-system (SIEMENS Multiline) since 06/1994, including 5,000 ESWL-sessions on ureteric stones. ESWL was done preferably in-situ with on-demand analgesia, according our BOOSTER-strategy (early retreatment, if fragments are >=3 mm). All relevant data have been recorded for statistical evaluation.

**Results**: Average treatment time was 50 minutes; 73 % of patients received i.v. analgesia with alfentanil (Ø1,7 mg). 98 % of stones fragmented within one ESWL-session. Retreatment rate was depending on stone size, strategy and SW-energy. Stones <=10 mm needed in 18 % additional ESWL; stones >10 mm in 38 %. The high retreatment-rate of 38 % in stones >10 mm, induced by BOOSTER-strategy was balanced by high stonefree-rate of 91 % after one week (98 % after 3 months) with a low rate of complications (12 % colics). Only 13,5 % of patients required auxiliary procedures (7,6 % before, 5,9 % after ESWL).

**Conclusion**: In-situ ESWL is an attractive treatment option for ureteric stones, regarding the high stonefree-rate, the low rate of complications and the feasibility of i.v. analgesia. ESWL-treatment of ureteric stones >10 mm is associated with a higher retreatment rate; the use of endoscopic measures should be taken into consideration.
ABSTRACT 121

NOVEL TECHNIQUE FOR RADICAL NEPHROURETERETOMY AND PARTIAL RESECTION OF BLADDER CUFF THROUGH A SINGLE INCISION WITH THE VIDEO-ASSISTED MINILAPAROTOMY SURGERY (VAMS)

Seung Choul Yang, Woong Kyu Han, Yong Seong Lee, Koon Ho Rha

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

Introduction: Laparoscopic nephroureterectomy (LNUX) with a bladder cuff resection has been performed as a minimally invasive surgery for the patients with carcinoma of the upper collecting system. However, it is difficult to manage the distal ureter and perform en block resection of bladder cuff without patient repositioning or intravesical approach. Therefore such challenging feature of LNUX prompted us to apply the previously reported technique for VAMS to treatment of the ureteral carcinoma. We aimed to report our experience with VAMS radical nephroureterectomy (VAMS-NUX) with bladder cuff resection through a single incision as a novel technique avoiding repositioning.

Methods: VAMS-NUX with bladder cuff resection was performed in 5 patients. The patient is placed in 30 degrees semilateral position and A 5 to 7 cm sized transverse skin incision is made anteriorly from the costal margin corresponding to the level of the 10th rib. The VAMS frame set for self-retaining retractor is assembled and one trocar (10mm) for telescope is placed. The kidney was resected in the usual VAMS radical nephrectomy fashion. The ureter was dissected down into the pelvis to the level of the bladder using laparoscopic dissectors and scissors through a previous incision site. The operating space around distal ureter can be obtained using 2 malleable blades and 1 piercing peritoneal retractor. With traction of distal ureter using laparoscopic grasper the bladder cuff was completely excised with electrical current and the defect of the bladder was sutured in the usual manner. The specimen was removed intact through the incision site.

Results: The mean time to resect the bladder cuff was 50 minutes (range 80 to 35). The mean estimated blood loss was 254mL. The mean operating time was 230 minutes, mean hospital stay 5.4 days, and mean time to a general diet 2.2 days. All patients had no complications such as postoperative urine leakage. Cystoscopic and computed tomography follow-up demonstrated no evidence of recurrence.

Conclusion: We believe the VAMS-NUX technique of distal ureteral management during radical nephroureterectomy has many advantages. This technique allows for complete resection of the kidney, distal ureter and a cuff of bladder through a single incision without patient repositioning.
CRYOABLATION OF RENAL MASSES AS A SALVAGE TECHNIQUE IN PATIENTS WITH A SOLITARY KIDNEY: INTERMEDIATE-TERM RESULTS

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Introduction: Cryoablative therapy may be a useful technique for the treatment of renal masses in patients with solitary kidneys where preservation of renal function is paramount. The purpose of this study was to evaluate the role of cryoablation in patients with solitary kidneys with the goal of tumor destruction or removal, and maximal renal parenchymal preservation.

Methods: 11 patients with single tumors were treated, of which 10 patients had solitary kidneys, 1 had a nonfunctioning contralateral kidney. Ten tumors were treated with in-situ cryoablation and 1 tumor was treated with cryo-assisted partial nephrectomy. All masses were biopsied prior to freezing. Procedures were performed under real-time intraoperative sonographic guidance. In each case, tumor was discernable with ultrasound, allowing for precise placement of cryoprobes. After cryoprobe placement, tumor masses were treated with 2 freeze cycles (- 40 degrees Celsius for 15 minutes per cycle) separated by an active thaw process. 10 tumors were left in situ and 1 was resected with a scalpel by tracing the edge of the ice ball. Results: Cryoablation was well tolerated by all patients without any perioperative complications. Mean patient age was 62.4 years (range 49-79), tumor location included: 7 (upper pole), 1 (mid-kidney), 3 (lower pole).

Results: Cryoablation was well tolerated by all patients without any perioperative complications. Mean patient age was 62.1 years (range 49-79), and the tumor location included: 4 (upper pole), 2 (mid-kidney), 3 (lower pole).

<table>
<thead>
<tr>
<th>Mean Values (Range)</th>
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<tr>
<td>Mean Tumor Size in (cm)</td>
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<tr>
<td>2.6 (1.2-4.3)</td>
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Mean hospitalization was 4.6 days (range 4-8). The patient that underwent cryo-assisted partial nephrectomy had negative margins. Ten patients received an MRI for a minimum of 4 months to a maximum of 43 months post-procedure. In nine patients, postoperative imaging has revealed no evidence of tumor recurrence. One patient had an enhancing area that is indeterminate for recurrence. One patient was lost to follow-up. Mean post-operative Cr was 1.57 (range 1.3-2.1) at a mean of 29 months post-procedure.

Conclusion: Intermediate-term results of renal cryoablation suggest that this technique may offer an advantage for patients that require a maximal nephron-sparing effort. Our results demonstrate preservation of renal function with minimal risk of tumor recurrence.
EFFECTS OF RESECTOSCOPE LOOP MANIPULATION

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Introduction: Urologic resectoscope loops are often manipulated to reposition the angle of the loop's projection within the sheath of the scope by the surgeon. The effects on the efficiency and functionality of the loop have never been tested. Our goal was to evaluate the changes in tensile strength, conductivity and dispersion of cautery effect due to these manipulations.

Material and Methods: Resectoscope loops manufactured by Karl Storz, Olympus, Boston Scientific and ACMI were evaluated. These loops were tested for tensile strength and unevenness of cautery effect before and after one manipulation from an angel of 15º posterior to 15º anterior deviation. Tensile strength was evaluated using the chattlion gauge to destruction point. Thermal effect was evaluated using a Circon loop energizer to 200 watts for 3 seconds on 032 and 034 resectoscope loops and a second test on 040 and 042 resectoscope loops using a Storz loop energizer to 240 watts for 3 seconds. Photography with infrared imaging was utilized to evaluate symmetry of cautery effect in the loop pre and post manipulation.

Results: Initial evaluation of the loops prior to manipulation demonstrated a tensile strength of approximately 40 pounds to failure, with a product specification to withstand a minimum of 3 pounds. After one manipulation, the tensile strength was reduced by 90.1% (p<0.001) with 46.7% of the loops tested failing to meet minimum industry required standards. Manipulation of the resectoscope loops increased the resistance of current within the resectoscope wire. Infrared photography confirmed cautery hotspots at the manipulated angle, bilaterally as well as cautery cold spots. Microscopic evaluation of the loops shows longitudinal fracture lines at the manipulated sites.

Conclusion: Physician manipulated resectoscope loop angles have a dramatic effect on the strength of the loop as well as the dispersion of energy. A bend of 30º results in 46.7% of loops to fail minimum tensile strength standards and alters the effectiveness and dispersion of electrical current on resected tissue. Infrared photography confirms the defect to be generated at the point of manipulation: thereby, reducing the anticipated capabilities at a constant setting of the loop energizer. Compensation by altering the current settings on the energizer only worsens the deteriorating loop's performance and lifespan. Ultimately, the quality of the surgical resection suffers from even one manipulation of a resectoscope loop, whether intentional or unintended. All four tested manufacturers of resectoscope loops experienced similar results with none showing any structural advantage.
ABSTRACTS – Session 1

ABSTRACT 124

NONLINEAR ANALYSIS OF KINEMATIC CHAINS WITH IMPACS

Dan B. Margitu, Eleonor D. Stoenescu

1Department of Mechanical Engineering, Auburn University, AL

Introduction: In this study a planar rigid-link mechanism with a rotating slider joint and clearance is investigated. The influence of the clearance gap size, crank speed, friction and impact parameters on the nonlinear behavior of the system are analyzed. Periodic response is observed for zero clearance and also at low crank speeds and low values of the coefficient of restitution for the mechanism with clearance. Chaotic motion is observed for relatively high crank speeds. The sliding joint with clearance is modeled using a kinematic coefficient of friction and a coefficient of restitution. Nonlinear dynamics tools are applied to analyze the simulation data captured from the connecting rod of the mechanism.

Methods: The Lyapunov exponents provide a measure of the sensitivity of the system to its initial conditions. They exhibit the average rate at which nearby trajectories converge or diverge in the state space and are used to distinguish the chaotic and nonchaotic behaviors. Periodic systems show only negative and zero exponents which indicate the convergence to a predictable motion. A positive exponent means that two close trajectories that start from almost identical conditions will move apart at an exponential rate as the time evolves. This rate, and hence the predictability of the system, is described by the largest of the Lyapunov exponents. Therefore, one needs to determine the sign of the Lyapunov exponents in order to characterize the behavior of the dynamic system.

Results: In Figure 1 a kinematic chain with slider clearance is shown. The kinetic coefficient of friction is 0.3 and the coefficient of restitution is 0.4. The analysis is performed for different values of the clearance c, varying the nominal angular velocity of the link 1. The largest Lyapunov exponent is computed for a set of simulation results for different values of the nominal angular velocity of the crank: 50 rpm, 100 rpm, 150 rpm, and 200 rpm. Figure 2 shows the results for the clearances: c=0.5 mm, c=1 mm, and c=1.5 mm. For constant clearance (c=constant), and for larger values of the nominal angular velocity one can obtain larger values of the Lyapunov exponent. Also, for constant nominal angular velocity and for larger values of the clearance one can obtain larger values of the Lyapunov exponent.

Conclusion: The Lyapunov exponents are computed for the simulated data and used as a diagnostic tool. For the mechanism with no clearance, the motion is periodic. Chaotic motion is observed for the mechanism with slider clearance. The largest Lyapunov exponents are compared for different crank speeds at different values of the clearance. For a constant value of the clearance, larger Lyapunov exponents correspond to higher crank speeds.
INTRODUCTION AND OBJECTIVE: Hemostatic parenchymal suturing is the most crucial part of laparoscopic partial nephrectomy (LPN). However, free-hand laparoscopic suturing under renal warm ischemia is a time-sensitive complex task. We describe a simpler technique of achieving renal parenchymal hemostasis after LPN.

METHODS: Between October, 2004 and August, 2005, a total of 14 consecutive select patients underwent LPN for renal tumor at our institution. In the first 5 patients (group 1) the traditional technique of LPN with free-hand parenchymal hemostatic sutures with knots was employed. The knotless parenchymal suturing technique was then used in the next 9 patients (group 2). Perioperative data was entered prospectively in an Institutional Review Board (IRB) approved database. In group 1, the mean age of the patients was 61.6 years (48-72), mean tumor size was 3.5 cms (1.1 - 5), mean BMI was 26.6 (20-33) and 3 tumors were left sided. In group 2, mean age was 61.5 years (51- 74), mean tumor size was 3.3 cms (1.8 - 4.5), mean BMI was 26.5 (22-31) and 3 tumors were left sided.

RESULTS: All 14 cases were completed without any open conversions or any complications. In group 1 (Free-hand knot technique, n=5), the mean operating time was 222.6 minutes (188 -270), mean tumor resection time was 5.2 minutes (4-6.5), 3 patients needed collecting system closure, mean number of parenchymal sutures needed was 4.6 (4-6), mean time for completing parenchymal suturing was 31 minutes (22-42), mean blood loss was 170 cc (50-300) and no patient had positive margins. In group 2 (Weck clip technique, n=9), mean operating time was 208.8 minutes (170-230), mean tumor resection time was 4.6 minutes (4-7), 6 patients needed closure of entry into the collecting system, mean number of parenchymal sutures needed was 4 (3-5), mean time for completing renal parenchymal suturing was 23.8 minutes (18-35), mean blood loss was 155.5 cc (50-350). There were no incidents of intraoperative or postoperative hemorrhage in both groups.

CONCLUSIONS: Laparoscopic partial nephrectomy has become an accepted treatment for renal tumor. However, due to the technical complexity of LPN suturing, under warm ischemia various attempts have been made to develop technologies to assist hemostasis during the procedure. To this end we have described an easily employable technique for achieving renal hemostasis during LPN.
ABSTRACT 126

A COMPARISON OF LAPAROSCOPIC, VIDEO-ASSISTED MINILAPAROTOMY, OPEN RADICAL NEPHRECTOMY FOR RENAL CELL CARCINOMA

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Introduction and Objective: We respectively compared the surgical outcomes of 2 forms of minimally invasive surgery, laparoscopic and video-assisted minilaparotomy (VAM) radical nephrectomy, with conventional open radical nephrectomy for renal cell carcinoma.

Methods: Data from patients who underwent laparoscopic (n=40), VAM (n=40), and open (n=35) radical nephrectomy were reviewed. Laparoscopic radical nephrectomy was performed transperitoneal approach. VAM radical nephrectomy was performed extraperitoneally by using a specially designed retractor system such as piercing abdominal wall elevator and telescope connected to a video monitor system.

Results: There were no significant differences among three groups undergoing laparoscopic, VAM, and open radical nephrectomy in terms of mean operative time (144.2 vs 150.5 vs 149.3 minutes, respectively). In mean hospital stay and estimated blood loss, there were no differences in 2 forms minimally invasive procedures (laparoscopic and VAM), but there was significant different from those of the open groups (p<0.05). Complications included 1 transfusion and 1 paralytic ileus in the laparoscopic group, 1 transfusion in the VAM group, 2 transfusion and 2 paralytic ileus in the open group.

Conclusions: Compared to open radical nephrectomy, laparoscopic and VAM radical nephrectomy were associated with less morbidity, equivalent surgical outcomes. In compared to 2 forms minimally invasive procedure, there were no significant differences in 2 groups, but there were more merits in view of postoperative pain and cosmetics in laparoscopic groups.
Abstract 127

MINIMAL TUMOUR ON PROSTATE BIOPSY:
THE TIP OF THE ICEBERG?

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Introduction: We evaluated whether a single positive core at biopsy is predictive of low tumour volume (TV), positive surgical margin (PSM) and extracapsular extension (ECE) at radical prostatectomy (RP).

Patients and Methods: 105 patients underwent RP following biopsy (median cores=14) over three years. 34 patients had only core positive for cancer (Group I) and 71 patients had more than one positive core (Group II). Group I consisted of 50% ‘minimal volume’ (<1mm) cancer [Ia], 26% ‘small volume’ (<3mm) cancer [Ib] and 24% the remainder [Ic]. RP specimen was assessed for TV%, PSM and ECE.

Results: Mean TV was 14% (Group I) vs 21% (Group II). Within Group I, mean TV was 15%(Ia) vs 9%(Ib) vs 17%(Ic). The number of patients categorised PSM and ECE was 26% and 18% in Group I, and 28% and 41% in Group II respectively. There were no significant differences in PSM between groups I and II but ECE was significantly different (p=0.025). Sub-analysis revealed significant differences in PSM for Group Ic vs Ia/Ib (p<0.05).

Conclusion: A single positive core is not predictive of low tumour volume. PSM is significantly less only when the core contains < 3 mm of cancer.
MRI-GUIDED ROBOT FOR AUTOMATED PROSTATE BRACHYTHERAPY

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Objectives: The exact placement of the radioactive seeds is crucial to achieve the desired treatment effect in brachytherapy of the prostate. Magnetic resonance imaging (MRI) provides the best visualization of the prostate as well as the possibility of real-time dosimetry during brachytherapy. However, MRI guidance is not commonly used in brachytherapy, due to compatibility problems related to the scanners. Since robots are known to be accurate manipulation devices, a robot directed by an MR image should be able to improve the precision of seed placement.

Methods: An MRI compatible robotic system was developed. The system is specifically designed for transperineal percutaneous prostate interventions and is currently customized to perform fully automated MRI-guided brachytherapy. The system, however, may be adapted for other image-guided interventions. In order to achieve MRI compatibility, the entire robot is built of non-metallic materials such as ceramics, plastics and rubbers. Additionally, a pneumatic stepper-motor was specifically developed for this application. Therefore the robot, including its motors, does not use any electricity whatsoever. These characteristics prevent the robot from creating any interference with the electromagnetic environment inherent to MRI technology.

Results: This development represents the first fully MRI compatible robotic system to be reported. The robot fits into any standard, closed-bore MRI scanner along with the patient. It is able to stay fully operational during MR imaging and it does not deteriorate the quality of the scan. Ex-vivo tests in tissue mockups have shown that the robot performs automated brachytherapy seed placement with an accuracy of 0.7 mm.

Conclusions: We present the first MRI compatible robotic system capable of fully-automated and highly accurate brachytherapy seed placement. We believe that due to its promising technology, this robot may become a useful future instrument in image guided prostate interventions.

Acknowledgement: This research was supported by grant CA088232 from the National Cancer Institute (NCI), the Prostate Cancer Foundation (PCF), and the American Foundation of Urologic Disease (AFUD). The contents are solely the responsibility of the authors and do not necessarily represent the official views of the NCI, PCF, or the AFUD.
SALVAGE TREATMENT OF PROSTATE CANCER RECURRENCE (rPCA) BY HIGH INTENSITY FOCUSED ULTRASOUND (HIFU)

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Introduction: rPCA after surgery, radiation, hormonal ablation or multiple local pretreatments is an increasing problem. As a small tumor volume, within scar, fibrotic tissue – visible in transrectal ultrasound and proven by biopsy – it can be treated locally, minimally invasive, in one session by HIFU through a non invasive rectal approach.

Methods: 114 patients with biopsy proven rPCA were treated by transrectal HIFU at 3.0 MHz (Ablatherm®, EDAP France): 8 had radiation (R), 30 had radical surgery (S), 36 hormonal ablation (HA) and 40 had multiple local pretreatments (M) as failed primary therapies. Tumor volumes were small (S = 4cc / R = 15cc / HA = 17cc / M= 8cc). Initial Gleason sum showed ≥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 20-39% intermediate low-medium grade stressincontinence. Side effects increased with number of local pretreatments.

Conclusion: HIFU by Ablatherm® is locally high effective - even in rPCA -, has a very low morbidity and acceptable side effects. It can be applied as „outpatient procedure“ in non obstructive small volume tumors. It is an interesting alternative salvage treatment for local control of recurrent prostatic cancer.
Introduction: A typical surgical problem during anastomosis is to find out where a suture can be placed safely. Tissues that suffer from calcified atherosclerosis react often more like a brittle material. Their tear strength is lower and so there is the possibility that the tissue will tear up after anastomosis. This problem makes the automation of suturing more difficult. Our goal is to develop a non-destructive way to assess the degree of calcification of tissues based on a compression test, which enables the surgeon to decide whether a tissue is suturable or not. We prove here the correlation between compression stiffness and degree of calcification.

Methods: Porcine aortas were obtained at slaughter and transported immediately in physiological solution to the laboratory. One hour after excising the aortas, they are placed alternately in two solutions for 10 minutes. This cycle is repeated 4 times. The first solution contains 133 mM Ca(NO₃)₂ and the second 80 mM K₂HPO₄. The Ca/P ratio is 5/3, which is the proportion of hydroxyapatite. The test is performed in a dynamical environment (4,85cm³/s) under physiological conditions. The healthy control group is kept in physiological solution during the calcification process. Rectangular samples (2 cm²) are taken from the blood vessel wall and intended with a cylindrical pounder (Ø6mm), while measuring the resulting force. The indentation speed is 1 mm/min. The load cell has a capacity of 5 N. There is no preconditioning and the side boundaries are free.

Results: 40 non-calcified healthy samples (green) and 20 calcified samples (red) have been tested to date. The average force-displacement curves show a significant difference between healthy and calcified aortas. The average stiffness at the end of the green curve is 4.2 N/mm, at the end of the green curve it is 5.6 N/mm. SEM shows calcium deposits on the surface(x1000).

Conclusions: (1) We can report a successful method to calcify aortic tissue. We can not yet prove calcium deposits on the inside of the tissue, which is the case with atherosclerosis. (2) The compression test seems to be a possible way to assess the degree of calcification in tissue. The next step in this research is to find out the correlation between compression stiffness and tear strength.
OBJECTIVES: critical analysis of the new Ablatherm® “integrated imaging” device for the local treatment of prostate cancer.

METHODS: prospective registration of treatment time, analysis of advanced treatment mode, its influence on learning curve and comfort for the operator. Comparison to the first serial Ablatherm® (4/00-9/05).

RESULTS: Important new features are: New applicator “ii”: real time control of prostate position and the automatic rectal wall recognition by integrated A and B mode TRUS at 7,5 MHz. No space and time consuming rotations/changes of the applicator during the treatment. Less rectal volume necessary and less treatment limitations in regard to bladder neck and seminal vesicles. New TRUS device: better visualisation of the prostate at 7,5 MHz. New software: simpler and faster software guidance through the treatment. Total treatment time is reduced by 25%. With sufficient knowledge in TRUS, computer use and prostate anatomy, learning curve is reduced to 5 treatments.

CONCLUSION: Ablatherm® treatment is now real “robotic” surgery of the prostate. Operators’ part of this treatment is, to position the patient correctly, to introduce the applicator, to define the borders of the prostate by integrated TRUS and to select the correct software in regard to the stage of disease. The treatment itself is automatic.

A major difference to all other prostate cancer therapies – and to other HIFU devices – is an automatic rectal wall control by A and B mode TRUS, autopositioning of the applicator, as most important security and treatment efficacy feature. This cannot be influenced / changed by the operator and guaranties high efficacy with low side effects - identically for any treatment -, independent from operators experience. There are no additional costs / risks for new user by a long learning curve. Ablatherm® is now a “one session robotic HIFU PCa therapy for the urologist”
ABSTRACTS – Session 2

POSTER 205

BEST PAPER AWARD

COMPUTER ASSISTED S3 NERVE ROOT NEUROMODULATION
BY CT SCAN AND ECHOGRAPHIC FUSION

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2 TIMC Laboratory, Faculté de Médecine, Domaine de la Merci, 38706 La Tronche cedex, France
3 KOELIS© - www.koelis.com

Introduction: S3 nerve root neuromodulation is an accepted therapy for individuals afflicted with lower urinary tract symptoms, such as idiopathic urinary urge incontinence, frequency, urgency, and urinary retention, who failed current standard therapies. Temporary sacral nerve stimulation is the first step as a test for final indication. It comprises the temporary application of neuromodulation as a diagnostic test to determine the best location for the implant and clinical efficiency. The implantation is done under local anaesthesia, with the patient in the prone position. In clinical practice, a needle is inserted in the S3 foramen and the proper location of the needle is confirmed both by the functional response and by fluoroscopy. If this test is positive, a permanent implantation is performed few weeks later. The accuracy of the placement of the electrode is a key criterion for the success of test and permanent implantation. We present a system, test on phantom and cadaver data, able to improve the precision and the reproducibility of this procedure, matching a preoperative CT scan with peroperative ultrasonic images into a navigation system.

Materials and Methods: The general approach included the following steps:

- A 3D pre-operative model was reconstructed from pelvis CT images (less than 5 minutes are necessary). The surgeon used this model to define a planning by selecting two points, a target and an entry point, which defined the needle trajectory.
- Just before puncture, intra-operative ultrasonic images, space localised by an infrared camera (Polaris® system, NDI Inc), are collected to get a set of 3D points located onto the posterior pelvis surface (Fig. 1 and 2). As echography was used here like a tool to locate the surface of the pelvis, it is not necessary that the target and the entry point be visible in the ultrasound images. For this step, the pelvis was segmented manually but this process can be automated.
- This set of 3D points was matched onto the preoperative model of the pelvis, by the mean of a registration technique. The matching transformation applied to the planned trajectory allowed transferring it to the operating room conditions and guarantees its correct execution. The position of the needle (18 Gauge) was known in real-time during the surgical action (thanks to the localizer and a rigid body fixed on the needle) and compared to the planned trajectory. Therefore, no further image acquisition was needed for this guiding phase.
In a first step, we tested this system on a pelvis bone to visually evaluate the precision. In a second step, we punctured three foramens on each side of a cadaver. We evaluated the precision of the punctures by carrying out a postoperative scanner with needles in place. By the mean of registration technique, we computed the distance between the preoperative target and the tip of the needle.

**Results:** On the phantom, the accuracy was visually estimated at ~ 1 mm (Fig. 3). On the cadaver, we computed a distance of 2.5 mm [1.7-3.2] between the preoperative target and the tip of the needle. The precision’s difference between tests on pelvis bone and cadaver was due to the deformation of the needle during the puncture.

**Conclusion:** These results are encouraging. We currently are working on the ability to perform the puncture without deformation of the needle. We think that this kind of tool could improve the precision of the implantation, decrease X-ray exposure and decrease local pain at site of puncture (anesthesia can be done exactly on the same way than the puncture of the implant).
REGISTRATION ALGORITHMS FOR ROBOTIC MRI-GUIDED PROSTATE BRACHYTHERAPY

Alex Patriciu1, Michael Muntener1, Doru Petrisor1, Michael Schar2, Louis R Kavoussi1, Dan Stoianovici1
1URobotics Laboratory, Department of Urology, Johns Hopkins Medicine; 2Philips Medical Systems

Introduction: An MRI compatible robot designed to interact with patients within the MRI scanner and to perform fully automated MRI-guided brachytherapy of the prostate was recently developed in our lab. One of its most distinct expected advantages is the increased precision of needle insertion and seed deployment using high-quality 3D image-guidance. To be able to place a needle robotically to a given point in the MR image space, it is necessary to compute the registration transformation between the robot and image spaces. We used a special marker embedded in the end-effector of the robot to compute this transformation and present here the comparative results of several registration algorithms.

Methods: The marker is composed of a line and an ellipse Fig. 1d. The MR images of the marker are used to recover the registration transformation from the robot to the image. Four control spheres are also placed on the robot end-effector. These control points are used to verify the registration. Three different registration algorithms were implemented and tested: 1) the line-ellipse (LE) algorithm automatically segments each slice and computes the median point of the marker. The registration transformation is computed by matching the points to the line and the ellipse; 2) the line-plane (LP) algorithm is similar to LE, the only difference is that the ellipse points are fitted to a plane; 3) image-model registration (IM) algorithm comprising two steps: an approximation of the registration is computed using the LP algorithm and this is subsequently enhanced using an image to model registration.

Results: The three registration methods were implemented and tested. The following procedure was used. The robot was placed in the MRI scanner. Six volumes were acquired with slice thicknesses of 0.5, 1, 2, 3, 4, and 5 mm, for the same position of the end-effector. The locations of the control points were determined from the finest dataset (0.5 mm). The other datasets were used for registration. The following error metrics were computed: A) Control Point Mean Error – calculated as the difference between the control point locations and their values obtained from the registration (Fig. 1a). B) Center Point Error – calculated similarly but for the imaginary center of the four control points (Fig. 1b). C) Needle Point Error – calculated similarly for the location of the needle point (Fig. 1c). The results show that the IM type of registration algorithm is very stable with the thickness of the MRI slicing. However, the LP registration gives comparable results and is computationally simpler.

Conclusion: The study shows that the registration marker allows for a target specified in the MR image of the prostate to be aimed within 0.25 mm. When the proper registration algorithm is used, precise registration can be achieved even with thick MRI slices, thus reducing scanning time. The presented algorithms will next to be evaluated in prostate models and animal studies.

Acknowledgement: This research was supported by grant CA088232 from the National Cancer Institute (NCI), the Prostate Cancer Foundation (PCF), and the American Foundation of Urologic Disease (AFUD). The contents are solely the responsibility of the authors and do not necessarily represent the official views of the NCI, PCF, or the AFUD.

21st EUS Annual Meeting, May 20, 2006, Atlanta, GA
**10 YEARS HIGH INTENSITY FOCUSED ULTRASOUND (HIFU) AS LOCAL TREATMENT OF PROSTATE CANCER: PROFILE OF SIDE EFFECTS**

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**Objectives:** prospective single center cohort study since 4/96. Until 11/05 > 1.300 HIFU treatments included. Registration/evaluation of any somatic side effect / complication / discomfort in follow up in an MS Access database, updated at each patient contact. Analysis after 10 years.

**Materials and Methods:** Patients undergoing local HIFU treatment for biopsy proven localized PCa with Ablatherm® (EDAP-Lyon) have been evaluated in regard to “post HIFU” side effects. All possible events were subdivided in 5 main groups/17 subgroups: systemic-, micturition-, infection-, sexual-, rectum/pelvis problems. 50 different events/ problems can be “registered”: from “intraoperative death” to “hemorrhoidal discomfort”. Each registered event in addition is combined with information about its “startdate”, “enddate”, “kind of therapy”, “QoL before therapy”, “QoL after therapy” and the correlation “HIFU treatment related or not”. These data are correlated to indication groups. All events with a frequency > 1 % as well as all events with a frequency of “0” are named.

**Results:** From 2.745 registered events, 42 % were judged “therapy related”: ranking of most frequent therapy related side effects:

<table>
<thead>
<tr>
<th>Side effects</th>
<th>Primary HIFU Mono</th>
<th>2nd HIFU</th>
<th>HIFU salvage after surgery</th>
<th>HIFU salvage after radiation</th>
<th>HIFU salvage after mult. Local pre Tx</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of patients</td>
<td>1.078</td>
<td>156</td>
<td>30</td>
<td>8</td>
<td>40</td>
</tr>
<tr>
<td>Catheter time (median days)</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td>Erectile dysfunction %</td>
<td>55</td>
<td>75</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>UTI %</td>
<td>9,5</td>
<td>15,2</td>
<td>13,6</td>
<td>8,7</td>
<td>18,3</td>
</tr>
<tr>
<td>Stress incontinence (&gt; 3m) %</td>
<td>1,7</td>
<td>2,2</td>
<td>19</td>
<td>29</td>
<td>39</td>
</tr>
<tr>
<td>TURP after (%)</td>
<td>5</td>
<td>2</td>
<td>5</td>
<td>50</td>
<td>5</td>
</tr>
<tr>
<td>Recto-urethral fistula (after 1999)</td>
<td>N=2</td>
<td>N=1</td>
<td>N=2</td>
<td>N=1</td>
<td>N=5</td>
</tr>
</tbody>
</table>

Neither intra-/ perioperative death, thrombosis or pulmonary embolism, nor the necessity of blood transfusion, emergency OR or intensive care occurred.

**Conclusions:** prospective registration of side effects and correlation to different indication groups show a low morbidity profile of local HIFU by Ablatherm® in short and medium range of max. 10 years. Side effects increase with the number of local pretreatments.
PATIENT CHOICE FOR NEPHRON SPARING SURGERY: INFLUENCE OF MINIMALLY INVASIVE SURGERY AND ABLATION

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Madison, WI.

Introduction and Objective: Nephron sparing surgery (NSS) has proven to be an effective means for treating small, localized renal tumors. As the number of methods for performing NSS increase, treatment selection becomes more difficult. This study examines the rationale for choosing a particular NSS modality.

Methods: At our institution four forms of NSS have been performed, 1. open partial nephrectomy (OPN), 2. hand-assisted laparoscopic partial nephrectomy (HALPN), 3. laparoscopic (LC) or percutaneous cryoablation (PC), 4. laparoscopic (LRF) or percutaneous radiofrequency ablation (PRF). A retrospective review of the minimally invasive NSS over the past three years was performed.

Results: Between 2003-2005, 131 patients underwent minimally invasive NSS including OPN 51, HALPN 20, LC 27, LRF 2, PC 16, PRF 15. In 2003 ablation accounted for 33% of NSS, in 2005 ablation account for 53%.

<table>
<thead>
<tr>
<th>Renal Mass (131)</th>
<th>Ablation (60) - CRI Risk (24), Comorbidities (11), Bleeding Risk (5), Age (2), Pt Choice (17)</th>
<th>Lap (29) - Adjacent Organ (11), Anterior/Medial Tumor (18)</th>
<th>RF (17) - Bleeding Risk (7), Lesion Size (6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Partial Nx (71) - AML (3), Definitive Tx Req (3), Age (16), Pt Choice (15), Tumor Loc (2)</td>
<td>Perc (31) - Bleeding Risk (5), Bilat CA (1), Comorbidities (6), Age (2), Pt Choice (11), Transplant (1)</td>
<td>Cryo (43) - Tumor Adj to Collect Sys. (8), Cystic RCC (5), Transplant (1), Lesion Size (24)</td>
<td>Lap (20) - Pt Choice (9)</td>
</tr>
<tr>
<td>Open (51) - Surgeon Pref. (8), Tumor location (6), Bilat Tumors (6), Tumor Size (4), Prior Surgery (3), Solitary Kidney (3), Concomitant Surg (2)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Conclusions: As new technologies emerge it is important to determine how each is best applied. Patient risk factors and tumor characteristics determined the treatment modality 54% of the time. When patient choice was involved, the patients always chose minimally invasive procedures, 11 cases for ablation and 9 cases for HALPN. In addition there appears to be a trend towards more ablative procedures at our center. Continued evaluation of outcomes and expectations will likely yield more objective data for selecting a particular NSS for small renal tumors.
POSTER 209

BIOGLUE® PRESENTING AS RADIOGRAPHIC EMPHYSEMATOUS PYELONEPHRITIS FOLLOWING LAPAROSCOPIC PARTIAL NEPHRECTOMY

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Introduction: BioGlue® Surgical Adhesive (CryoLife, Inc., Atlanta, Georgia, USA) is a two-component surgical adhesive composed of purified bovine serum albumin and glutaraldehyde. During application, the adhesive solutions are mixed to create a mechanical seal, which attains hemostasis on the tumor resection bed during the laparoscopic partial nephrectomy (LPN). We hereby present our initial series of patients who had BioGlue® applied during LPN, then presented with subsequent radiographic appearance of emphysematous pyelonephritis.

Material and Methods: From April 2005-November 2005, eleven (11) LPN’s were performed. Following tumor excision, parenchymal reconstruction was then performed. Then, BioGlue® was applied onto the repair site with a laparoscopic applicator. At 3 months postop, a surveillance CT was obtained on all available patients.

Results: Radiographic emphysematous pyelonephritis was seen in all available 7 surveillance CT’s (Fig. 1). These were performed on asymptomatic patients who presented for routine surveillance CT. We attribute the emphysematous appearance to the air pockets trapped in the BioGlue® seal (Fig. 2). Review of surveillance CT scans performed on postoperative LPN patients that had no BioGlue® revealed no air pockets. To confirm the BioGlue® phenomenon in vitro, we placed a sample on cardboard and performed a CT scan of the capsule, which revealed air pockets (Fig. 3).

Conclusions: Due to its viscous consistency and its ability to harden quickly, BioGlue® forms a capsule onto the defect created during LPN. During injection, air is invariably incorporated into the seal, which creates an “emphysematous” capsule on surveillance CT. Awareness of this phenomenon can help avoid confusion and alarms surgeons and radiologists on surveillance CT scans.
NIRIS OPTICAL COHERENCE TOMOGRAPHY SYSTEM: APPLICATION IN UROLOGY AND ROBOTIC-ASSISTED SURGERY

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Cleveland OH

Introduction: Optical Coherence Tomography (OCT) was first introduced in 1991 as a new imaging modality, using near infrared light interferometry for visualization of biotissues microstructure. OCT fills an important spatial scale gap between imaging modalities, and provides cross-sectional images with up to 2 mm penetration depth and high spatial resolution. Multiple OCT studies, currently in progress and completed, explore OCT’s efficacy in several areas of potential applications, including early cancer detection, biopsy guidance and optical biopsy, differential diagnosis, preoperative and intraoperative guided surgery, organ-preserving resection and prevention of iatrogenic injury. We report early results in the application of the Niris™ Imaging System - the world’s first FDA cleared OCT imaging system for non-ophthalmic use (Fig. 1).

Materials and methods: Niris is based on common-path all-fiber interferometer topology, which make it insensitive to probe length, wave dispersion and polarization distortions and therefore very convenient for both manufacturing and clinical use. It acquires real-time images with 200x200 pixels, 15 µm free space in depth resolution (11 µm in tissue), and 25 µm lateral resolution. A universal reusable 8 Fr Niris probe (2.7 mm OD) can be used standalone, in instrumental channels of many standard endoscopes or in a specialized disposable sterile plastic holder. To date, we have enrolled 18 patients in urinary bladder studies and 48 patients in retroperitoneal studies including exploring OCT as an aid in nerve visualization in radical prostatectomy and retroperitoneal lymph node dissection, using open, laparoscopic and robotic-assisted procedures.

Results: From 66 patients, we obtained more than 1400 OCT images of tissue structures including prostate, neurovascular bundles (NVB), sympathetic chains, fat, kidney, urethra, ureter, aorta, colon, bladder, seminal vesicles, vas deferens, and prostatic pedicles. Early comparison with parallel histology was performed in bladder and retroperitoneal cases and suggests that OCT can help to identify flat bladder cancers when used in combination with white light cystoscopy (Fig 2 a, b). In retroperitoneal cases OCT can be used to identify the NVB during open, laparoscopic and robotic-assisted radical prostatectomies (Fig.2 c,d).
Conclusion: We report preliminary results in use of an FDA-cleared, common path OCT system in different urological applications. In particular, noninvasive in vivo visualization of flat bladder lesions during cystoscopy and NVB during open, laparoscopic and robotic-assisted surgery looks promising to identify early bladder cancer and minimize iatrogenic injury and improve potency and continence preservation, respectively. Further research will be needed, including parallel histology and follow up, to prove the OCT value and substantiate it in clinical use.
HISTOTRIPSY OF THE PROSTATE: FEASIBILITY OF NON-INVASIVE CAVITATIONAL ULTRASOUND TISSUE ABLATION

Kathleen Kieran, Timothy L. Hall, J. Stuart Wolf, Jr., J. Brian Fowlkes, Charles A. Cain, William W. Roberts
The Michigan Urology Center and The Department of Biomedical Engineering, University of Michigan, Ann Arbor, MI

Introduction: Widespread prostate cancer screening in the United States has resulted in earlier diagnosis of prostate cancers in men who are younger and healthier than in the past. As many of these patients have a lengthy life expectancy, a premium has been placed on developing effective techniques that minimize morbidity and maintain post-surgical quality of life. To this end, there exists a need for a non-invasive technology capable of precise prostate tissue ablation without injury to adjacent critical structures.

Methods: We have developed and tested an annular 18-element phased ultrasound array system capable of delivering high intensity (>20 kW/cm²), short ultrasound pulses (15 cycles = 20 microsec) at pulse repetition frequencies from 15-200 Hz. to induce cavitation within the targeted volume. Following approval from the institutional animal care committee, ultrasound pulses were delivered transcutaneously to the prostates of 4 anesthetized dogs in a 9-point grid configuration with 3 mm spacing between points to ablate a 1 cm³ volume of tissue. A 5 MHz diagnostic ultrasound imaging probe provided in-line real-time imaging of the focal zone. Immediately following treatment, the prostate was fixed in 10% formalin, sectioned, and prepared with H & E staining.

Results: In vivo results demonstrate that clinically relevant tissue volumes can be effectively ablated using histotripsy. In all four canine experiments, a cavity containing a thin paste with clearly demarcated boundaries was observed in the gross section of the ablated canine prostate tissue. No observable damage was found in surrounding prostate structures. H&E slides indicated extensive acellular debris without any remaining cellular structure in the ablated region, surrounded by a narrow margin of cellular injury. Ultrasound imaging of the treated area demonstrated a temporally and spatially changing hyperechoic (bright) zone during treatment. Significant speckle amplitude reduction within the treated volume is an indicator of effective tissue fractionation/ablation.

Conclusions: Histotripsy (cavitational ultrasound) is a promising transcutaneous therapy capable of precise prostate tissue destruction. Large tissue volumes can be effectively treated with use of an electronically steerable ultrasound phased array. Initial results from prostate ablations are promising and demonstrate the feasibility of this technology. Experiments are currently underway to establish the non-viability of the residual liquefied material within the ablation zone following treatment and to assess the differential cavitational threshold between prostate tissue and periprostatic structures such as the neurovascular bundle, urinary sphincter, and rectal wall.

Figure: A. H&E slides of the ablated canine prostate tissue. Within the ablated region, no cellular structures remained. B. Expanded view of the tissue damage boundary, indicating a sharp transition zone of about 100 µm.
POSTER 212

3D EVALUATION OF KIDNEY MOVEMENT DURING RESPIRATION USING 2.5D ULTRASOUND

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Introduction: The evaluation of kidney movement during respiration has been addressed in 1994 by Schwartz, using fast-echo MRI on 14 volunteers. Under normal respiration, he reported an average motion of 16mm and an average mobility of 2.9mm, the mobility being the re-positioning error between two breathing cycles. However, the MR modality does not provide a sufficient resolution to clearly distinguish the kidney frontiers, especially at the poles, and furthermore it does not allow the screening of the movement in “true” 3D. In this study we aim at proving the feasibility of measuring the 3D movement (motion+mobility) of the kidney with the help of localized freehand ultrasound.

Methods: On 11 healthy volunteers, static and dynamic acquisitions of the right kidney were made through anterior access. The static acquisition consisted in sweeping the localized probe over the kidney after deep inhale, then after deep exhale. The dynamic acquisition consisted in placing the probe in the motion plane, and acquiring kidney median slices in real-time during several breathing cycles. With an image resolution of 0.3mm per pixel, this allowed to reconstruct clouds of kidney-shaped 3D points. Using a rigid least-squares registration, we could measure precisely distances GG’, PP’, and angles γG, γP, α, as described in the figures aside.

Results: Thanks to 3D registration we were able to measure distances and angles along the actual course of the organ. The range and average values for motion and mobility are shown hereunder. The values for the mobility basically depend on the corpulence of the volunteers. We may remember an average displacement of 30mm and 12°. Since no breathing assistance was used, the replacement of the kidney was dependent on the volunteers’ ability to control their breathing. On average we obtained 4mm and 7°. The best replacement was 2.3mm and 2°, which gives hope to prove high repeatability under general anesthesia circumstances.

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<tr>
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<th>GG’</th>
<th>PP’</th>
<th>γG</th>
<th>γP</th>
<th>α</th>
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<tbody>
<tr>
<td>Motion Range</td>
<td>10.1-60.0</td>
<td>7.8-55.5</td>
<td>9.1-129.7</td>
<td>11.2-134.9</td>
<td>6.5-17.5</td>
</tr>
<tr>
<td>Average</td>
<td>30.1</td>
<td>30.8</td>
<td>48.3</td>
<td>52.7</td>
<td>11.6</td>
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<th></th>
<th>GG’</th>
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<tbody>
<tr>
<td>Mobility Range</td>
<td>1.8-12.4</td>
<td>1.9-2.4</td>
<td>2.0-18.9</td>
</tr>
<tr>
<td>Average</td>
<td>4.0</td>
<td>4.3</td>
<td>6.7</td>
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Conclusion: We showed the feasibility of measuring in 3D both motion and mobility of the kidney using 2.5D ultrasonography. The average values are coherent with the literature, although we believe that using a high-resolution freehand modality yields more reliable results. In the future we intend to reiterate the tests using breathing assistance on volunteers, before going to the OR as a last stage. The influence of age, sex, size and weight, should be evaluated as well. Dedicated software is available.
ABSTRACTS – Session 2

POSTER 213

COMPUTER ASSISTED INTRARENAL ACCESS BY CT AND ULTRASOUND IMAGE FUSION

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Introduction: Percutaneous access to kidney is a challenging technique that meets with the difficulty to reach rapidly and accurately an intra-renal target. Our system provides the surgeon with a pre-operative 3D planning on computed tomography (CT) images. After a rigid registration with space-localized ultrasound (US) data, preoperative planning can be transferred to the intra-operative conditions and an intuitive man-machine interface allows the user to perform a puncture.

Material and Methods: CT and US images of informed normal volunteer were obtained to perform calculation on the accuracy of registration and punctures were carried out on a kidney phantom to measure the precision of the whole of the system. The general approach included the following steps:

- A 3D pre-operative model was reconstructed from abdominal CT images by the mean of some segmentation computer tools (Analyze©, Nabla©). The surgeon used this model to define a planning by selecting two points, a target and an entry point, which defined the needle trajectory.
- Just before puncture, intra-operative ultrasonic images, space localized by an infrared camera (Polaris® system, NDI Inc), are collected at the end of an inspiration to get a set of 3D points located onto the kidney surface (Fig 1 & 2). As echography was used here like a tool to locate the surface of the kidney, it is not necessary that the target and the entry point be visible in the ultrasound images. For this step, the kidney surface was segmented manually.
- This set of 3D points was matched onto the preoperative model of the kidney, by the mean of a registration technique. The matching transformation applied to the planned trajectory allowed transferring it to the operating room conditions and guarantees its correct execution. The position of the needle, usually used in clinical practice (18 Gauge – 200 mm long), was known in real-time during the surgical action (thanks to the localizer and a rigid body fixed on the needle, Fig 2) and compared to the planned trajectory (Fig. 4). Therefore, no further image acquisition was needed for this guiding phase.
In a first step, we estimated visually the precision of the registration between CT and echographic images of our human volunteer. In a second step, we performed three punctures on a right and left kidney on a phantom (Model 057 – CIRS). We evaluated the precision of the punctures by carrying out a postoperative scanner with needles in place. By the mean of registration technique, we computed the distance between the preoperative target and the tip of the needle.

**Results:** We carried out millimetric registrations on real data (Fig. 3) and guidance experiments on a kidney phantom showed results of 4.7 mm [3.3 – 6.1] between planned and reached targets. We noticed that the most significant error was related to the needle deflection during the puncture.

**Conclusion:** Preliminary results are encouraging but further work will be undertaken:

- To take breathing into account in real time even if some preliminary studies in our team demonstrate that the position of the kidney between 2 inspirations appear to be reproducible.
- To improve efficiency to register CT and US images without segmentation (one of our study highlights that correlation ratio turned out to be the most accurate and appropriate similarity measure to be used).
- Accuracy. A solution could be to use a magnetic localizer and a coil inside the tip of the needle.
DIGITAL VIDEO ARCHIVAL AND TELE-RETRIEVAL (DIV-ART)
FOR ROBOTIC SURGERY

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**Introduction:** Video archival of minimally invasive surgical procedure is an important tool for training, mentoring, quality control and development of surgical steps. Conventionally video archival is performed by recording the procedure on a magnetic video tape (VT) or on a digital videodisk (DVD). In a center with high surgical volume the media management creates many logistical challenges like cataloging and storing for the media in HIPPA compliant manner. Reviewing these recording at a later date is a time and resource consuming, as it involves manual retrieval of the media and cueing the media to the operating step being reviewed. Lastly, the number of media’s physical copies limits the number of people reviewing the material.

We perform more than 700 robotic surgical procedures every year. To address our media management concerns we have developed an automated system for Digital Video Archival and Tele-retrieval (DIV-ART).

**Methods:** The DIV-ART consists of a video acquisition suite and a video archival and distribution center. The video acquisition suite placed in the operating room, has Ingest™ Capture Work Station (Intel P4 3.0GHz/800MHz, 2MB, 1GB RAM, 250 GB HDD S-ATA, MPEG 2 Capture board, WinXP, and a custom designed software). The Capture station captures surgical video as MPEG2 file @ 6MBPS. A bar code reader connected to Ingest enters patient identification, procedure type and operative step as tagged metadata to the video file. Names of various operative steps are bar coded on sterile labels. The scrub tech swipes specific sterile labels in front of the barcode reader at the initiation of the particular operative steps. This enters the “operative step” metadata, which is linked to time code of the video file. Time code link enables a direct jump to a specific operative step in the video file without cuing the whole media.

The MPEG 2 files are transmitted though a dedicated fiber backbone to ProxSys™ server placed on our office floor. This Linx based server has SQL relational database, video server and a web server. The ProxSys™ is connected to a 4.4 TB storage (2 TB Raid disk array and a 80 disk Ultrahigh Density Optical disk –capacity 30GB each disk Plasmon™ Jukebox). The server is connected to hospital network and can be accessed through a secured web based access from any computer in the network. The ProxSys™ web interface provides various levels of access privileges. The video files can be searched by submitting a query for any combinations of metadata of specific dates, patient identifications or a particular operative step. The video clips are displayed on as a MPEG4 preview file to save transfer time of large MPEG2 file. Full resolution MPEG2 version of the complete clip or selected portion of the clip can be downloaded from the server for review or presentation.

**Results:** After installation we have recorded 46 cases of Vattikuti Institute Prostatectomy on the DIV-ART. Our average disk space requirement for the procedure is 5GB per case. At our current capacity we can have online archival of videos of more than 850 cases online. Our average video retrieval time has reduced by 68% as compared to the conventional video recordings. The video can be retrieved from any computer in our intranet and can be viewed at multiple stations simultaneously.

**Conclusion:** DIV-ART is a HIPPA compliant video archival system. Its automated workflow has made storage and review of the surgical videos more efficient.
ABSTRACTS – Session 2

POSTER 215

A 4-IN-1 SILICONE TRAINING AID FOR PRACTICING
LAPAROSCOPIC SKILLS AND TASKS

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James Borin MD, Ralph V. Clayman MD

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Objective: Suturing continues to be the challenging factor in the application of laparoscopic techniques to reconstructive urological surgery. Various models, designed for use in a standard pelvic trainer, have been created to facilitate learning this difficult skill; but they tend to be costly and have limited applications. We have developed a simple, inexpensive model to simulate pyeloplasty, urethrovesical anastomosis, bladder injury repair, and reconstruction following partial nephrectomy.

Materials and Method: A commercially available liquid silicone (Smooth-On Inc., Easton, PA) was applied evenly in a 1 mm layer to the outside of a standard wine glass with a bowl diameter of 2.75 inches, a bowl length of 3.75 and a stem length of 2.75 inches. After allowing the silicone to cure for 35 minutes, another coat was applied and this process was repeated 3 times until a 3-4 mm thickness of silicone had accumulated. A releasing agent was applied to the wine glass prior to silicone application to prevent the silicone mold from sticking, allowing it to remain extremely pliable and easy to remove from the glass without tearing or distorting its shape. Opaque and translucent models were created, the former by adding a pigment to the translucent model.

Seven laparoscopically trained surgeons evaluated the models and completed a questionnaire. The models were also utilized by several urologists undergoing laparoscopic skills training; an evaluation questionnaire was completed.

Results: The seven experienced laparoscopic surgeons considered the models to be an accurate representation of the four different urologic procedures. The silicone provided a satisfactory simulation of tissue and was able to be sutured using the same suture of choice used during a standard laparoscopic procedure; the suture passed easily through the silicone, closely simulating tissue. The models were durable and able to be re-used to practice multiple procedures during the training program. On average, each model could be used from 5-15 procedures before discarding Novice surgeons also thought the model was useful in helping them learn complex surgical skills. In addition the novice surgeons felt it helped them practice procedure specific task (e.g. pyeloplasty or urethrovesical anastomosis). Estimated cost per model is $23.00 which includes material and time.

Conclusion: We present a simple, inexpensive model for simulated practice of suturing and knot tying associated with laparoscopic pyeloplasty, urethrovesical anastomosis, repair of bladder injury and partial nephrectomy. This model, which appears to have both face and content validity, may be used in a pelvic trainer or with the daVinci™ robot to practice the complicated suturing skills required for laparoscopic urologic reconstructive procedures.
THE LEARNING CURVE FOR ROBOTIC-ASSISTED LAPAROSCOPIC RADICAL PROSTATECTOMY: A MULTI-INSTITUTIONAL EXPERIENCE OF LAPAROSCOPIC AND ONCOLOGIC TRAINED UROLOGISTS


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Introduction: While open radical prostatectomy remains the standard for the surgical management of localized prostate adenocarcinoma, the growing interest in laparoscopic radical prostatectomy (LRP) and robotic-assisted radical prostatectomy (RARP) is evident by the steadily increasing number of these procedures performed annually. RARP is becoming more prevalent in the urologic community, most notably at academic medical centers. We report on the collective academic experience of robotic-assisted prostatectomy in the New York and New Jersey metropolitan area.

Methods: Of 23 academic institutions in the New York Section of the American Urological Association, 14 (60%) are equipped with daVinci™ Surgical Systems. A total of 23 urologic surgeons at 13 of these institutions were determined to have experience in performing minimally invasive prostatectomies (21 RARP, 2 LRP). Each of the surgeons that perform robotic-assisted prostatectomies was invited to complete a survey regarding their training, and experience with open, laparoscopic, and robotic-assisted prostatectomy.

Results: The mean age of the 16 surgeons who responded was 39 (range 32-53 years) and was comprised of ages 30-39 (n=11), 40-49 (n=3), and 50-59 (n=2). The mean number of years in practice was 5.1 (range 1-22 years). Fifteen surgeons (94%) had fellowship training in laparoscopy/endourology (n=8) or urologic oncology (n=7). Surgeons had diverse backgrounds in laparoscopic surgery. All surgeons had experience in performing open prostatectomies including: < 50 cases (n=1), 50-100 (n=3), 101-200 (n=4), 201-300 (n=4), 301-400 (n=1), 401-500 (n=0), > 500 (n=3). The median number of LRPCs performed was 7 (range 0-160), and RARPs was 53 (range 8-1200), consisting of: < 50 cases (n=8), 51-100 (n=4), 101-200 (n=1), 201-300 (n=2), 301-400 (n=0), 401-500 (n=0), > 500 (n=1). The mean number of robotic-assisted procedures at which point a surgeon was comfortable with the procedure was 38 cases.

Conclusions: Minimally invasive surgery for localized prostate cancer is increasing in popularity. The learning curve for robotic-assisted prostatectomy appears to be dependent on (1) experience with open prostatectomy and (2) experience with laparoscopic prostatectomy. Factors that did not impact the learning curve include age of the surgeon, specific fellowship training in laparoscopy or oncology, and the number of general laparoscopic cases performed prior to performing robotic-assisted prostatectomy.
Objective: The aim of this study was to investigate the stage-depending efficacy and side-effects of HIFU in patients with localized prostate cancer within six months after treatment.

Patients and Methods: From December 2002 to March 2005 129 men were treated and subsequently monitored. Repeated prostate biopsy was recommended after six months. The median age of the patients was 69.4 yrs. (51-82 yrs.). The health status was ASA I-II in 81 and ASA III-IV in 48 men. Median PSA at diagnosis was 7 ng/dl (0.5-77 ng/dl). Median prostate volume was 23 ml (7.7-144 ml). The clinical tumor stage was T1A/B in 31, T1C-2A in 63 and T2B-T3B in 35 patients. The Gleason-score was 2-4 in 21, 5-6 in 68 and 7-10 in 40 men. 55 patients received neoadjuvant hormonal therapy with a median duration of 8 weeks (1-244 weeks). Treatment was performed by using the Ablatherm HIFU unit (Edap-Technomed). 61 men were treated by HIFU only while 68 men with larger glands (AP-diameter >2.5cm) underwent a TURP (n= 66) or transvesical adenomectomy (n=2) before HIFU.

Results: 126/129 patients could be evaluated after a median follow-up of 25 weeks (19-28 weeks). The median PSA decreased to 0.15 ng/dl with 101 men (80%) exhibiting a PSA < 1 ng/dl. 24/126 patients refused a prostate biopsy. Of these 15 had a PSA < 0.5 and 9 had a PSA of 0.8 to 38.4 nd/dl. Of the remaining 102 men 85 (83%) presented with negative biopsies. The rate was 20/22 (91%) in tumor stage T1A/B, 44/52 (84%) in stage T1C-2A and 21/28 (75%) in stage T2B-3B. Regarding the Gleason-score the rates were 14/17 (82%) in Gleason 2-4, 45/54(83%) in Gleason 5-6 and 26/31 (84%) in Gleason 7-10. 1/129 men (0.8%) died from acute myocardial infarction (age 71 yrs., ASA II) at the fifth postoperative day. Major urological side-effects were initial obstruction (45= 35%) with the need of secondary transurethral intervention in 17 men (13%), temporary urge incontinence (46= 35%), UTI (36=28%), epididymitis (9=7%) and rectal fistula (1=0.8%).

Conclusion: Already after six months HIFU provides a sufficient reduction of the PSA-levels and local control even in locally advanced carcinoma and regardless of the Gleason-score. Treatment can be offered to elderly patients and those with increased comorbidity. Specific side-effects such as obstruction, urge incontinence and UTI may require further urological care.
ABSTRACTS – Session 2

POSTER 218

FOUR-ARM daVinci™ SURGICAL SYSTEM FOR EXTRAPERITONEAL LAPAROSCOPIC ROBOTIC PROSTATECTOMIES

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Mutahar Ahmed, George Dakwar Newark, NJ Hackensack, N.J
Vincent Lanteri, Hackensack, NJ

Introduction and Objective: The laparoscopic prostatectomy is a relatively new approach for the treatment of localized prostate cancer. Since its introduction, there have been many different advances in its technique and in its technology. For example, it has been discovered by our experience that an extraperitoneal approach is superior to the original intraperitoneal one. One of the more recent advances in this technology includes the introduction of a four-arm robot as opposed to the classic three-arm. We discuss the advantages of the four arm robot in an extraperitoneal laparoscopic robotic prostatectomy (EP-LRP).

Methods: In a 3 year period, 410 patients with localized prostate cancer underwent an EP-LRP using the 4-arm daVinci™ robot. The mean age of the patients was 57.6 years with an average PSA of 5.9 and a Gleason score of 6.2. Clinical stage: 301 patients with T1C, 109 patients with T2A or higher. The setup of the EP-LRP requires 5 ports, four of which are operated by the surgeon at the console; the last port is operated manually by an assistant. The setup of the 3-arm ER-LRP also requires 5 ports, 3 of which are operated by the surgeon, and two by one or two assistant. The role of the assistant in both 3-arm and 4-arm procedures include aligning and exchanging robotic instruments as well as using conventional laparoscopic equipment for suctioning, retraction and suture passing. Peri-operative, postoperative and pathologic results were analyzed.

Results: Particular attention to trocar position was necessary to avoid collision of the arms. The fourth arm emanated from the central column on the surgical cart. This arm was routinely docked as an accessory right-sided robotic arm and was brought in below the patient's right lower extremity, which was placed in a boot-stirrup. The four-arm system allowed for functional transition between three instrumented arms, allowing two arms for operative maneuvering and one for exposure, leaving only suctioning and applying of clips to the assistant. The additional arm was generally equipped with a grasper-dissector. The total mean operative time was 140 minutes. Mean blood loss was 125 cc. The mean hospital stay was 1.1 days. Foley catheter removal averaged 5.1 days. Positive margin rate was 15%. Three patients required transfusion. One patient required exploratory laparotomy for bleeding. Two patients presented post op with pelvic urinoma, successfully managed with percutaneous drainage.

Conclusions: We have found from our experience with both the 3 arm and 4 arm daVinci™ robots that the fourth arm provides the primary surgeon with an added degree of independence, which helped to facilitate all aspects of the prostatectomy. The increased amount of control, which the surgeon has during the case, allowed for better tissue plane exposure and dissection. Lastly, important of all the addition of the fourth arm eliminates the necessity of a highly trained laparoscopic assistant.
INITIAL EXPERIENCE OF REAL-TIME TRANSRECTAL ULTRASONOGRAPHY DURING MINILAPAROTOMY RETROPUBIC RADICAL PROSTATECTOMY

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Introduction and Objective: We introduced the initial experience of intra-operative application of transrectal ultrasonography (TRUS) during laparoscopic radical prostatectomy (LRP) (J Urol, 172, 112, 2004). TRUS navigation greatly contributed to better understanding of periprostatic anatomy. In addition to laparoscopic approach, minilaparotomy retropubic radical prostatectomy (MRP) is currently reported as a less invasive surgery as well as having the potential of early recovery of urinary incontinence following surgery, comparing with the conventional retropubic approach. The aim of this study is to assess whether or not the established real-time TRUS navigation can facilitate in the procedure of minilaparotomy and improve functional and oncological outcomes.

Methods: In 54 consecutive patients undergoing MRP, real-time intra-operative and immediate post-operative TRUS navigations were performed. Quality of intra-operative TRUS imaging such as the neurovascular bundles (NVB), prostate apex, membranous urethra, bladder neck and rectal wall was individually analyzed prior to the excision of the prostate. After the excision of the prostate, the lengths of membranous urethra were compared with those which were measured prior to the excision. Vascular signals in the nerve sparing site were monitored under the power Doppler guidance postoperatively.

Results: Similar to the results in LRP, imaging qualities of intra-operative TRUS in the NVB, prostate apex, membranous urethra, bladder neck and rectal wall were excellent in all the cases. The average lengths of membranous urethra before and after the surgery were 11.2 mm and 11.7 mm, respectively. The excision of the prostate resulted in no significant differences, and showed similar ranges comparing with those results in LRP. Vascular signals at the nerve sparing site were clearly depicted after the excision of the prostate. With respect to the rate of positive distal surgical margin, use of TRUS navigation resulted in a 6% decrease of positive margin.

Conclusions: TRUS information significantly helped the surgeons to tailor the apical dissection appropriately with maximal membranous urethral length preservation as well as the avoidance of unexpected rectal injury. Real-time TRUS monitoring is feasible in MRP.
THE IMPACT OF ROBOTIC TECHNOLOGY ON 5-YEAR RADICAL PROSTATECTOMY PRACTICE PATTERNS AT THE FIRST INSTITUTION WITH 3 daVinci™ SURGICAL SYSTEMS

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Introduction: Open radical prostatectomy is the standard for the surgical management of localized prostate adenocarcinoma. The steep learning curve for laparoscopic prostatectomy poses a challenge for surgeons with minimal laparoscopic experience. As robotic-assisted surgery becomes more prevalent in the urologic community, practice patterns appear to be changing. We report on the impact of robotics in the treatment of localized prostate cancer at a single medical center (Hackensack University Medical Center).

Methods: A retrospective review was conducted of all radical prostatectomies performed at a single institution between January, 2000 and December, 2005. Our medical center is the first institution with 3 daVinci™ Surgical Systems; 2 were acquired in 2000 and 1 was acquired in 2002.

Results: A total of 917 radical prostatectomies were performed by 14 surgeons, including 445 (49%) open radical retropubic prostatectomies (RRP) and 472 (51%) robotic-assisted radical prostatectomies (RARP). The annual number of prostatectomies increased annually [2000 (n=90), 2001 (n=125), 2002 (n=143), 2003 (n=151), 2004 (n=143), 2005 YTD (n=124)]. RARP was performed by 3 (21%) surgeons from 2001-2003, by 7 (50%) surgeons in 2004, and by 9 (64%) surgeons at present. As more surgeons became trained in robotic-assisted surgery, the trend gradually shifted towards robotic-assisted prostatectomy [2000 (100% RRP / 0% RARP), 2001 (90% RRP / 10% RARP), 2002 (72% RRP / 28% RARP), 2003 (60% RRP / 40% RARP), 2004 (27% RRP / 73% RARP), 2005 YTD (4% RRP / 96% RARP)]. The mean estimated blood loss, pain medication requirement, hospital stay, and convalescence were significantly less for the RARP cohort (p<0.001).

Conclusions: At our institution, the acquisition of multiple daVinci™ Surgical Systems has led to the gradual adoption of robotic-assisted surgery by the majority of the urological surgeons that treat prostate cancer. As a result, the percentage of open prostatectomies steadily decreased over time, while trends in the robotic-assisted group increased. Moreover, it is evident that impact of robotics has had a positive effect on the total number of prostatectomies performed annually. Practice patterns appear to be changing as the robotic surgical system has allowed surgeons to overcome the challenges of conventional laparoscopy, thus making minimally invasive radical prostatectomy a more widely available alternative to open surgery. The introduction and availability of this novel technology has directly resulted in the acceptance and adoption of robotic-assisted prostatectomy at a single institution, and may be reflective of future trends at other institutions that offer robotic-assisted surgery.
RETROGRADE INTRAVESICAL RECONSTRUCTIVE SURGERY (RIVRS): 
NEW TECHNIQUE FOR ENDOSCOPIC MANAGEMENT OF LOWER 
URETER IN UPPER TRACT TCC AND PARTIAL BLADDER 
RESECTION AND PRIMARY RECONSTRUCTION.

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Department of Urology, Muljibhai Patel urological hospital, Nadiad, India

Introduction and objective: Retrograde intravesical surgery has been in vogue since the advent of endoscopy, however its application was limited to diagnostic, and ablative, including removal of the stones, tumor and foreign body. Minimally invasive surgery on the bladder was started as early as 90’s when laparoscopy made its way into urology. In this novel technique we have shown bladder resection and intramural ureteral resection with bladder cuff and primary bladder reconstruction done endoscopically.

Patient and methods: Four patients, three of whom had pelvic TCC underwent laparoscopic nephroureterectomy and endoscopic bladder cuff and intramural ureteral resection with primary bladder suturing as a simultaneous procedure. Another patient with bladder stone grown over the IUCD (Intrauterine contraceptive device) which had perforated the uterus and implanted into the bladder wall underwent partial bladder resection and primary endoscopic reconstruction.

Technique: After the patient has been placed in supine oblique lithotomy position bladder resection was done using a combination of hook cautery,colling’s hook and endoscissors.Bladder closure was done by 2 – 3 endostitches (extracorporeal knotting) using 3-0 vicryl were taken endoscopically using SR-5 endosuturing instrument. Resection part of the procedure was done with distilled water as bladder irrigation and normal saline while the bladder is being sutured.

Results: Average patient age was 57 yrs and mean BMI was 28.5. Overall operative time for the bladder intervention is 60 min (mean) with female patients taking relatively less time. Average number of sutures required are 2 (range 1-3). Cystogram was done on the day of catheter removal (5th POD).None of the patients had any complications. Average hospital stay was 4 days. Average analgesic requirement was 100 gms. Check cystoscopy after 4 weeks revealed normal bladder healing. Mean follow up is 9 months. None of the patients had tumor recurrence.

Conclusion: RIVRS is an efficient, minimally invasive and reproducible technique for endoscopic management of lower ureter in upper tract TCC and for partial bladder resection with primary bladder closure in selected cases.
EVALUATION OF THE BENIQUE SOUND, A UNIQUE DEVICE TO ASSIST URETHROVESICAL ANASTOMOSIS DURING LAPAROSCOPIC RADICAL PROSTATECTOMY

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Introduction and Objective: Laparoscopic radical prostatectomy is a widely accepted treatment option for organ confined prostate cancer. However, free hand laparoscopic intracorporeal suturing required for the urethrovesical anastomosis, remains of concern. Few techniques have been previous described to assist in the laparoscopic urethrovesical anastomosis. To this purpose, we have evaluated an innovative urethral sound to assist suturing while performing laparoscopic radical prostatectomy.

Methods: Between April 2004 and October 2004, twenty two consecutive patients underwent laparoscopic radical prostatectomy for organ confined prostate cancer at our institute by a single surgeon (APR). Patients were randomized to undergo the procedure with either a regular 16 Fr Van Buren sound, (group I, n=12) (Figure 1) or a new urethral sound with a pistol grip handle (Karl Storz, KS 27566) (Group II, n=10). This sound is 25 cm long with an external diameter of 16 Fr and a 5cm distal tip curved 65 degrees. The sound has a working channel throughout its entire length, which allows placement of a guide wire through it. The urethral sound was used initially in the procedure to manipulate the prostate gland to aid in placing the dorsal vein stitch as well as help delineate the bladder neck at the time of anterior bladder neck division. The sound was then used to retract the prostate and aid dissection of the posterior bladder wall and the seminal vesicles. The sound was also used during the vesicourethral anastomosis to guide the needle tip into the urethra.

Results: All 22 laparoscopic procedures were completed successfully without open conversion. In group I (regular urethral sound), the mean time to complete the urethrovesical anastomosis was 37 minutes (range 30 - 45), whereas in group II (Benique urethral sound), it was 26 minutes (range 22 - 42), (p=0.04). Blood loss was comparable in the two groups (200 vs 230 cc respectively, p=0.3). Mean catheter duration in group I was 5 days (range 3 - 7) and in group II was 5.4 days (range 3 - 8), (p=0.8). There were no complications in either group.

Conclusions: We surmise that the unique pistol grip design of the Benique sound facilitates placement of anastomotic urethrovesicular sutures during laparoscopic radical prostatectomy. A secure grip affords controlled, smooth, and coordinated movements during the anastomosis and foley catheter placement is made easier with guide wire placement through the working channel of the Benique sound.
LAPAROSCOPIC RADICAL CYSTECTOMY: EARLY ONCOLOGICAL OUTCOME

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Introduction: We present our center’s experience in laparoscopic radical cystectomy for selected patients with muscle invasive bladder cancer with emphasis on immediate postoperative results as well as early the oncological outcome.

Methods: Between February 2002 and September 2005, we performed a total of 31 laparoscopic radical cystectomies for muscle invasive bladder cancer on 26 males and 5 females. All cystectomies were performed completely intracorporeal while urinary diversion was done extracorporeally through a minilaparotomy. Evaluation of the procedure was done as regards operative time, blood loss, intraoperative complications, postoperative morbidity, surgical margins, and pathological type, grade and stage.

Results: The mean operative time for laparoscopic radical cystectomy was 260 minutes (±77 minutes), while the mean operative time for urinary diversion was 180 minutes (±48 minutes). The mean blood loss was 600 cc (±70cc) with a 40% transfusion rate. No intraoperative complications were encountered with no conversion to open surgery done during the laparoscopic part of the procedure. Postoperative complications included renal impairment in one, prolonged urinary leakage in four, prolonged lymphatic leakage in four, and primary hemorrhage in one. There was one postoperative mortality from disseminated intravascular coagulation in a patient with liver cirrhosis. Histopathological examination confirmed negative surgical margins in all retrieved specimens. The pathological types were adenocarcinoma in one, squamous cell carcinoma in twelve and transitional cell carcinoma in eighteen patients. Twenty three patients had a histological grade II tumor, while eight patients had a grade III tumor. The 2002 TNM staging for these tumors were pT2-a in nine, pT2-b in eight, pT3-a in five, pT3-b in seven and pT4 in two. Positive lymph nodes were found in four patients. After a mean follow-up of 18 months, three patients developed local recurrence and two patients developed liver metastases and died during follow-up. There was also one non-cancer related mortality.

Conclusion: Laparoscopic radical cystectomy is a feasible alternative to conventional open radical cystectomy for selected patients with muscle invasive bladder cancer. The early oncological outcome is comparable to open surgery however longer follow-up is needed to assess the long-term cancer control and survival.
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