Engineering and Urology Society

36th Annual Meeting

Sunday Apr 30, 2023

Chicago, IL

https://engineering-urology.org/
The Engineering and Urology Society holds its 36th Annual Meeting: “Precision Surgery and Artificial Intelligence Standards” on Sunday, April 30th in Chicago, Illinois. The mission of the Engineering and Urology Society, a subsection of the Endourological Society, is to promote the development and application of new technology in urology through facilitating collaboration between engineers, physicists, and urologists.

We have organized a distinct program that highlights the latest advances in robotic urologic surgery platforms, intraoperative guidance using artificial intelligence (AI), and integrated biosensing systems to address unmet clinical needs in urologic cancer, infections, and stone disease. Our multidisciplinary speakers are comprised of leading urologic surgeons, engineers, and promising early-stage investigators. They will speak about the development, validation, integration, and dissemination of these emerging technologies, as well as a call towards standardization in conducting research studies and reporting outcomes. Representative topics include initial reporting of a novel endoscopic robotic system; emerging AI applications in surgical education, kidney stone disease, prostate cancer, and bladder cancer; integrated biosensors for rapid infection diagnostics, and a smart toilet for precision health monitoring.

Two poster sessions in the afternoon provide researchers with the opportunity to present their work and update the attendees on the progress on the field and latest innovations. Overall, the review of the abstracts for the poster sessions was performed by a group of 36 international reviewers. We would like to thank the reviewers, listed at the end of this program book, for their essential contribution to the quality of the meeting and their constructive comments that they made for the research.

Based on the review scores, the Society awards three closely ranked top abstracts this year. These are listed at the end of this program book, together with the Top 10 abstracts, and Best Reviewer Awards. The authors of all awarded abstracts are invited to submit full length articles to the Journal of Endourology on the respective topics. We gratefully thank all reviewers for their hard work, objective scoring, and contribution to the success of the meeting. We thank Dr. George Nagamatsu the founder and first president of the society, and Dr. Jack Vitenson the first Society Treasurer for setting up the foundations based upon which we meet.

Please visit the website https://engineering-urology.org/ for a complete version of this program including the abstracts presented.

We welcome all urologists, engineers, scientists from industry and academia to join us for this cross-disciplinary experience.

Joseph Liao, M.D.
President, Engineering and Urology Society

Dan Stoianovici, Ph.D.
Executive Director, Engineering and Urology Society
The Focal Therapy Society (FTS) in partnership with the Endourological Society, aims to advance and position minimally invasive, image-targeted cancer treatment in a safe, effective, gland-preserving manner to extend and maintain quality of life. Our vision is to control or eradicate prostate or kidney cancer in a minimally invasive, image-targeted manner while optimizing the preservation of organ function. The Focal Therapy Society aims to promote: (1) the highest possible standards in clinical practice; (2) continuing education and research in focal therapy (FT), image-guided targeting and relevant imaging; (3) the public interest in the use of FT and image-guided targeted therapies; (4) a forum for the exchange of ideas and methodology for FT and related basic, clinical, and translational sciences. The FTS supports and maintains an international registry open to all participating collaborators for the collection of real-world physician experience utilizing FT including outcomes and complications.

Focal therapy entails a combination of image-guided ablation of clinically significant cancer along with subsequent active surveillance (AS) of the treated and monitoring of untreated low-grade cancer after treatment. Image-guided targeted therapy remains the least invasive method to manage prostate and kidney cancer. Provided that patients are appropriately selected, AS and FT have the lowest side effect profiles and the greatest likelihood of preserving quality of life. Today, we are better able to determine which tumors can be safely monitored, and those that can be effectively targeted and ablated in the most minimally invasive fashion.

The FTS will feature state-of-the-art presentations on FT topics of interest during the Endourological Societies’ Specialty Day Sunday April 30 at the AUA in Chicago. Our next FTS annual meeting, the 13th International Symposium on Focal Therapy and Imaging in Prostate and Kidney Cancer will be held in Washington DC Sept 8-9, 2023, along with a special session with the FDA on these technologies Sept 7. We welcome all stakeholders interested in these topics to join us and visit our website https://focaltherapy.org/.

Thomas Polascik, M.D.
President and Program Chair, Focal Therapy Society
"Endourology Society Day"
Sunday, April 30th, 2023
7:00am – 6:00pm EDT
Marriott Marquis Chicago, Grand Horizon ABC
Chicago, Illinois

7:00am – 3:30pm
Engineering & Urology Society (EUS) and Focal Therapy Society (FTS)
Joint Meeting
Engineering & Urology Program Chair: Joseph Liao, MD
Executive Director: Dan Stoianovici, PhD
https://engineering-urology.org/

Focal Therapy Society Chair: Thomas Polascik, MD
https://focaltherapy.org

1:00pm – 5:30pm
Society of Urologic Robotic Surgeons (SURS) Meeting
Program Chair: Ashutosh Tewari, MD
https://sursroboticsurgery.org/

5:30pm – 6:00pm
SURS Business Meeting
<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Presenter / Moderator</th>
</tr>
</thead>
<tbody>
<tr>
<td>7:00AM</td>
<td>Registration</td>
<td></td>
</tr>
<tr>
<td>7:45AM</td>
<td>Welcome</td>
<td>Joseph Liao</td>
</tr>
<tr>
<td>7:50AM</td>
<td>Development and Initial Clinical Experience of a Novel Endoscopic Robotic Platform: Monarch PCNL</td>
<td>Jaime Landman</td>
</tr>
<tr>
<td>8:05AM</td>
<td>Emerging Robotic Surgery Platforms</td>
<td>S. Duke Herrell</td>
</tr>
<tr>
<td>8:20AM</td>
<td>Developing Standardization for Surgical AI</td>
<td>Andrew Hung</td>
</tr>
<tr>
<td>8:35AM</td>
<td>AI applications for Stones, URS Technology</td>
<td>Khurshid Ghani</td>
</tr>
<tr>
<td>8:50AM</td>
<td>AI Medical Imaging Analysis for Prostate Cancer</td>
<td>Mirabela Rusu</td>
</tr>
<tr>
<td>9:05AM</td>
<td>Computer Vision and AI for bladder cancer</td>
<td>Audrey Bowden</td>
</tr>
<tr>
<td>9:20AM</td>
<td>Engineering Rapid Diagnostics for Surgical Infections</td>
<td>Pak Kin Wong</td>
</tr>
<tr>
<td>9:35AM</td>
<td>AI Augmented Cystoscopy and TURBT</td>
<td>Eugene Shkolyar</td>
</tr>
<tr>
<td>9:50AM</td>
<td>Smart Toilet as a Precision Health Platform</td>
<td>Tianjia Ge</td>
</tr>
<tr>
<td>10:00AM</td>
<td>Discussion</td>
<td></td>
</tr>
<tr>
<td>10:10AM</td>
<td><strong>Awards Presentations</strong></td>
<td>Dan Stoianovici</td>
</tr>
<tr>
<td>10:15AM</td>
<td>Magnetic Retrieval of Stone Fragments: Design, Prototyping and Head-To-Head Comparison with Stone Retrieval Basket</td>
<td>Daniel Massana Roquero</td>
</tr>
<tr>
<td>10:20AM</td>
<td>Enhanced Assessment of Urodynamics in a Patient-Specific, In-Vitro Model of the Bladder Using Dynamic 3D MRI and Particle Image Velocimetry</td>
<td>James Rice</td>
</tr>
<tr>
<td>1:00PM –</td>
<td><strong>Poster Sessions (Grand Horizon EFG)</strong></td>
<td>Dan Stoianovici</td>
</tr>
<tr>
<td>2:00PM –</td>
<td>Session 1</td>
<td>Salvatore Micali</td>
</tr>
<tr>
<td>2:30PM –</td>
<td>Session 2</td>
<td>Pengbo Jiang</td>
</tr>
<tr>
<td>3:30PM –</td>
<td></td>
<td>Tareq Aro</td>
</tr>
<tr>
<td></td>
<td></td>
<td>George E. Aninwene II</td>
</tr>
<tr>
<td>Time</td>
<td>Title</td>
<td>Presenter / Moderator</td>
</tr>
<tr>
<td>--------</td>
<td>-----------------------------------------------------------------------</td>
<td>------------------------------</td>
</tr>
<tr>
<td>10:30AM</td>
<td>My Pathway to Focal Therapy: Rationale for Novel Treatment of Prostate Cancer</td>
<td>Herbert Lepor</td>
</tr>
<tr>
<td>10:45AM</td>
<td>Selecting an Energy Source for Focal Therapy</td>
<td>Mark Emberton</td>
</tr>
<tr>
<td>11:00AM</td>
<td>Who is a Candidate for Focal Therapy Incorporating MRI Assessment</td>
<td>Peter Pinto</td>
</tr>
<tr>
<td>11:15AM</td>
<td>Functional and Oncological Outcomes</td>
<td>Thomas Polascik</td>
</tr>
<tr>
<td>11:30AM</td>
<td>Horizons for Focal Therapy: Prostate and Kidney</td>
<td>Art Rastinehad</td>
</tr>
<tr>
<td>11:45AM</td>
<td>Case Presentation</td>
<td>Rafael Sanchez Salas</td>
</tr>
<tr>
<td>Time</td>
<td>Event Description</td>
<td></td>
</tr>
<tr>
<td>-------</td>
<td>-----------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>12:45PM</td>
<td>Welcome and SERS Update: <strong>Introduction Semi-Live Sessions</strong></td>
<td></td>
</tr>
<tr>
<td>12:50PM</td>
<td>Young Urologist/Rising Stars Video Session</td>
<td>AUA Robotics Theater Finalist Encore Performance</td>
</tr>
<tr>
<td>1:15PM</td>
<td><strong>Robotic Prostate Surgery Semi-Live Video Session</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Panelists: Ashutosh Tewari, Jihad Kaouk, Thomas Ahlering, John Davis, Francesco Montorsi</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Retzius Sparing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>How I Do My Apical Dissection</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SP Trasvesical</td>
<td></td>
</tr>
<tr>
<td>2:00PM</td>
<td><strong>Single Port Robotic Surgery</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Panelists: Soroush Rais-Bahrami, Jeffrey Nix</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Utilizing SP to Facilitate Extraperitoneal Approach for Prostate Surgery</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SP Retroperitoneal Partial Nephrectomy-Gibson Approach</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Troubleshooting Steps of Single Port Robotic Procedures – Lessons Learned</td>
<td></td>
</tr>
<tr>
<td>2:45PM</td>
<td><strong>Robotic Kidney Surgery</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Panelists: Ketan Badani, Chandru Sundaram, Francisco Porpiglia</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Complex Robotic Partial Nephrectomy</td>
<td></td>
</tr>
<tr>
<td></td>
<td>RPN Tumor Excision-Tips to Avoid Positive Margins</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Robotic caliceal diverticulectomy: a simple minimally invasive solution to a vexing problem</td>
<td></td>
</tr>
<tr>
<td>3:30PM</td>
<td><strong>Robotic Cystectomy/Diversion</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Panelists: Amar Singh, Alvin Goh, Reza Mehrazin, Mutahar Ahmed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cystectomy Techniques</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Diversion Techniques</td>
<td></td>
</tr>
<tr>
<td>4:30PM</td>
<td><strong>GU Robotic Reconstruction</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Upper Urinary Tract Reconstruction</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lower Tract Reconstruction</td>
<td></td>
</tr>
<tr>
<td>5:30PM</td>
<td><strong>SERS Business Meeting</strong></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>Title</td>
<td>Presenting Author</td>
</tr>
<tr>
<td>----</td>
<td>----------------------------------------------------------------------</td>
<td>----------------------------</td>
</tr>
<tr>
<td>1</td>
<td>NOVEL ANTI-REFLUX “RELIEF” STENT TO PREVENT VESICOURETERAL REFLUX</td>
<td>Michael Callegari</td>
</tr>
<tr>
<td>2</td>
<td>BURST WAVE LITHOTRIPSY OF OBSTRUCTING URETERAL STONES IN A DOLPHIN</td>
<td>Arturo Holmes</td>
</tr>
<tr>
<td>3</td>
<td>IS IT SIZE OR FIRMNESS THAT MATTERS? EXAMINING DIFFERENT MINIATURE PERCUTANEOUS NEPHROLITHOTOMY ACCESS SHEATHS</td>
<td>Gregory Mullen</td>
</tr>
<tr>
<td>4</td>
<td>VALIDATION OF A NOVEL KIDNEY PATHOLOGY PHANTOM DESIGNED FOR ULTRASOUND TRAINING FOR PERCUTANEOUS RENAL BIOPSY AND PELVIS PUNCTURE</td>
<td>Nelson Stone</td>
</tr>
<tr>
<td>5</td>
<td>DEVELOPMENT OF A MALE INSERTION METHOD FOR A CATHETER-FREE AMBLUATORY CYSTOMETRY DEVICE</td>
<td>Madison Lyon</td>
</tr>
<tr>
<td>6</td>
<td>SECOND-LOOK FLEXIBLE URETEROSCOPY AFTER RIRS—HOLMIUM MOSES VERSUS TLF (SOLTIVE)</td>
<td>B Geavlete</td>
</tr>
<tr>
<td>7</td>
<td>BILATERAL SAME-SESSION FLEXIBLE URETEROSCOPY FOR RENAL STONES: EFFICACY AND SAFETY</td>
<td>B Geavlete</td>
</tr>
<tr>
<td>8</td>
<td>VESICOURETHRAL ANASTOMOSIS IN TRANSVESICAL SINGLE-PORT ROBOTIC RADICAL PROSTATECTOMY (SP-RARP): A TECHNICAL DESCRIPTION AND PERIOPERATIVE OUTCOMES</td>
<td>Nicolas A Soputro</td>
</tr>
<tr>
<td>9</td>
<td>EFFICACY FOR ROBOT-ASSISTED FLUOROSCOPIC RENAL PUNCTURE IN MITIGATING LEARNING CURVE FOR PCNL</td>
<td>Kazumi Taguchi</td>
</tr>
<tr>
<td>10</td>
<td>SAFETY AND FEASIBILITY OF THE CVAC™ CALCULUS VACUUM ASPIRATION CATHETER</td>
<td>Andrea Moyer</td>
</tr>
<tr>
<td>11</td>
<td>A RANDOMIZED CONTROLLED TRIAL OF TRUS-ROBOT VS. URONAV BIOPSY IN THE DIAGNOSIS OF CLINICALLY SIGNIFICANT PROSTATE CANCER, PRELIMINARY RESULTS</td>
<td>Michael E. Rezaee</td>
</tr>
<tr>
<td>12</td>
<td>ARTIFICIAL INTELLIGENCE FOR AUTOMATED SEGMENTATION OF PROSTATE CANCER AND PELVIC ANATOMY</td>
<td>Sakina Mohammed Mota</td>
</tr>
<tr>
<td>13</td>
<td>EVALUATION OF RENAL FUNCTION AND STENT DURABILITY FOLLOWING RESONANCE STENT PLACEMENT FOR BENIGN DISEASE</td>
<td>Rohit Bhatt</td>
</tr>
<tr>
<td>14</td>
<td><strong>TOP 10 ABSTRACT</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>SIMULATION OF ENERGY ABSORPTION DURING LOW INTENSITY SHOCKWAVE THERAPY IN THE FLACCID AND ERECT PENIS</td>
<td>Irwin Goldstein</td>
</tr>
<tr>
<td>15</td>
<td>A BENCHTOP KIDNEY MODEL FOR MEASURING INTRARENAL PRESSURE DURING SIMULATED URETEROSCOPY</td>
<td>Alycia Abbott</td>
</tr>
<tr>
<td></td>
<td>Title</td>
<td>Author</td>
</tr>
<tr>
<td>---</td>
<td>----------------------------------------------------------------------</td>
<td>-------------------------</td>
</tr>
<tr>
<td>16</td>
<td>INITIAL CLINICAL EXPERIENCE OF A HIGH-DEFINITION SINGLE-USE FLEXIBLE CYSTOSCOPE</td>
<td>Zachary Kornberg</td>
</tr>
<tr>
<td>17</td>
<td>PROTOTYPE DEVELOPMENT FOR NOVEL DEVICE TO PREVENT URETHRAL TRAUMA ASSOCIATED WITH ACCIDENTAL CATHETER REMOVAL</td>
<td>Tova Weiss</td>
</tr>
<tr>
<td>18</td>
<td>3-DIMENSIONAL SHOCKWAVE MODELING OF SECONDARY REFLECTORS IN LOW INTENSITY SHOCKWAVE THERAPY FOR ED</td>
<td>Irwin Goldstein</td>
</tr>
<tr>
<td>19</td>
<td>COMPUTATIONAL FLUID DYNAMICS OF BLADDER VOIDING USING 3D REAL-TIME MRI</td>
<td>Labib Shahid</td>
</tr>
<tr>
<td>20</td>
<td>PERIOPERATIVE OUTCOMES AMONG SINGLE-PORT AND MULTI-PORT ROBOTIC ADRENALECTOMY: A SINGLE INSTITUTIONAL EXPERIENCE</td>
<td>Jennifer Nguyen</td>
</tr>
<tr>
<td>21</td>
<td>BEST ABSTRACT AWARD</td>
<td>Ayberk Acar</td>
</tr>
<tr>
<td></td>
<td>A METHOD FOR NAVIGATION DURING ENDOSCOPIC KIDNEY SURGERY</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>BEST ABSTRACT AWARD</td>
<td>Daniel Massana Roquero</td>
</tr>
<tr>
<td></td>
<td>MAGNETIC RETRIEVAL OF STONE FRAGMENTS: DESIGN, PROTOTYPING AND HEAD-TO-HEAD COMPARISON WITH STONE RETRIEVAL BASKET</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>TOP 10 ABSTRACT</td>
<td>Renea Sturm</td>
</tr>
<tr>
<td></td>
<td>ACHIEVING A BLADDER ACELLULAR MATRIX WITH PRESERVED ARCHITECTURE AND MECHANICS OF THE HEALTHY NATIVE BLADDER</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>TOP 10 ABSTRACT</td>
<td>Shree Agrawal-Patel</td>
</tr>
<tr>
<td></td>
<td>VARIATION IN AUS PRESSURE REGULATING BALLOONS AND CUFF FOLLOWING EXPLANATION</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>THULIUM FIBER LASER: IMPACT OF PULSE WIDTH MODULATIONS ON TEMPERATURE GENERATION</td>
<td>Eric Riedinger</td>
</tr>
<tr>
<td>26</td>
<td>GRAVITY-INDEPENDENT CATHETER DESIGN TO REDUCE INTRAVESICAL PRESSURE</td>
<td>Susanna Ferrier</td>
</tr>
<tr>
<td>27</td>
<td>A PROVIDER-PATIENT INTERACTIVE APP TO AUDIO-RECORD AND SHARE PATIENT CONSULTATIONS AND DECISION-MAKING DISCUSSION</td>
<td>Maurice Garcia</td>
</tr>
<tr>
<td>28</td>
<td>GENDER-BASED DIFFERENCES IN SURGEON ERGONOMICS DURING SIMULATED URETEROSCOPY USING EMG</td>
<td>Erin Kim</td>
</tr>
<tr>
<td>29</td>
<td>PENILE TUMESCENCE CHARACTERIZATION USING A NOVEL PENILE “SMART RING”</td>
<td>Riley Daily</td>
</tr>
<tr>
<td>30</td>
<td>THREE-DIMENSIONAL MODELING APPLICATIONS FOR SURGICAL SPATULATION FOR UROLOGIC RECONSTRUCTION</td>
<td>Samhita Mallavarapu</td>
</tr>
<tr>
<td>31</td>
<td>ROBOTIC RADICAL PROSTATECTOMY USING NOVEL APPROACHES IN PATIENTS WITH A HOSTILE SURGICAL ABDOMEN</td>
<td>Albert Geskin</td>
</tr>
<tr>
<td>32</td>
<td>AN EXTENSION TO A LUMPED-PARAMETER MODEL FOR KIDNEY PRESSURE DURING STONE REMOVAL</td>
<td>Jessica Williams</td>
</tr>
<tr>
<td>Page</td>
<td>Title</td>
<td>Presenter</td>
</tr>
<tr>
<td>------</td>
<td>----------------------------------------------------------------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>33</td>
<td>RADIOFREQUENCY ABLATION OF RENAL TUMORS 3-7 CM WITH DIRECT REAL TIME TEMPERATURE MONITORING USING NON-CONDUCTING FIBEROPTIC THERMISTORS: TECHNIQUE AND 14-YEAR FOLLOW UP OF ONCOLOGIC AND RENAL FUNCTION OUTCOMES</td>
<td>Benjamin Behers</td>
</tr>
<tr>
<td>34</td>
<td>USE OF STENCILS FOR DESIGNING THE NEOPHALLUS GLANS RIDGE FOR TRANSGENDER MEN UNDERGOING PHALLOPLASTY</td>
<td>Maurice Garcia</td>
</tr>
<tr>
<td>No</td>
<td>Title</td>
<td>Presenting Author</td>
</tr>
<tr>
<td>-----</td>
<td>----------------------------------------------------------------------</td>
<td>-------------------------</td>
</tr>
<tr>
<td>35</td>
<td>PRESSURE DYNAMICS GENERATED BY URETEROSCOPIC IRRIGATION DEVICES: A COMPARATIVE STUDY OF PATHFINDER BULB, BSC SINGLE-ACTION PUMP, AND NOVAPLUS PRESSURE BAG DEVICES</td>
<td>Ali S. Antar</td>
</tr>
<tr>
<td>36</td>
<td>ENGINEERING BURST WAVE LITHOTRIPSY FOR NONINVASIVE FRAGMENTATION OF URETEROLITHS IN PET CATS</td>
<td>Adam D. Maxwell</td>
</tr>
<tr>
<td>37</td>
<td>AN AUGMENTED REALITY XR HEADSET IMPROVES HAND-EYE COORDINATION WHEN USED AS THE PRIMARY MONITOR</td>
<td>Nelson Stone</td>
</tr>
<tr>
<td>38</td>
<td>DE-NOVO METHOD OF SURGICAL DATA ANALYSIS USING Revo-® SUB-BLOCK ANALYZER IN CLASSIFYING THE PROCEDURE CHARACTERISTIC WITHOUT IMAGING DATA</td>
<td>Hyung-Joo, Kim</td>
</tr>
<tr>
<td>39</td>
<td>DEVELOPMENT OF A BIOMECHANICAL FEEDBACK SYSTEM FOR FLEXIBLE URETEROSCOPY</td>
<td>Jayson Kemble</td>
</tr>
<tr>
<td>40</td>
<td>7.5 VERSUS 8.4/9.4 FR FLEXIBLE URETEROSCOPES IN THE “NO TOUCH TECHNIQUE” OF RENAL STONE TREATMENT</td>
<td>B. Geavlete</td>
</tr>
<tr>
<td>41</td>
<td>PASSIVE DEFLECTION OF SINGLE-USE URETEROSCOPES FOR DIFFICULT APPROACHES IN RENAL STONES</td>
<td>B. Geavlete</td>
</tr>
<tr>
<td>42</td>
<td>DEVELOPMENT OF A LIQUID BIOPSY USING EXTRACELLULAR VESICLES TO ASSESS THE SYSTEMIC T CELL IMMUNE LANDSCAPE IN BLADDER CANCER</td>
<td>Karen Doersch</td>
</tr>
<tr>
<td>43</td>
<td>ONCOLOGICAL AND FUNCTIONAL OUTCOMES OF SALVAGE CRYOTHERAPY FOR THE MANAGEMENT OF PROSTATE CANCER BIOPSY-PROVEN RECURRENCE AFTER PRIMARY BRACHYTHERAPY VERSUS PRIMARY CYROTHERAPY: A PROPENSITY SCORE-MATCHED ANALYSIS</td>
<td>Sriram Deivasigamani</td>
</tr>
<tr>
<td>44</td>
<td>RECONCILING Discordance BETWEEN PIRADS-4 LESIONS AND TARGET BIOPSY HISTOLOGY- EARLY EXPERIENCE WITH A STRUCTURED MULTIDISCIPLINARY QUALITY IMPROVEMENT PROTOCOL AND PI-RADS 4 SUBCATEGORIZATION</td>
<td>Sriram Deivasigamani</td>
</tr>
<tr>
<td>45</td>
<td>TOP 10 ABSTRACT</td>
<td></td>
</tr>
<tr>
<td></td>
<td>In-Vivo THERMAL TISSUE MAPPING IN A PORCINE MODEL DURING LASER ACTIVATION</td>
<td>Ron Marom</td>
</tr>
<tr>
<td>46</td>
<td>TOP 10 ABSTRACT</td>
<td></td>
</tr>
<tr>
<td></td>
<td>EXTRACAPSULAR EXTENSION RISK ASSESSMENT USING AN ARTIFICIAL INTELLIGENCE PROSTATE CANCER MAPPING ALGORITHM</td>
<td>Alan Priester</td>
</tr>
<tr>
<td>47</td>
<td>A NOVEL PROSTATE BIOPSY SYSTEM FOR HIGH QUALITY BIOPSY SAMPLES FOR COMPUTATIONAL PATHOLOGY</td>
<td>Jeffrey Proctor</td>
</tr>
<tr>
<td>48</td>
<td>INITIAL EXPERIENCE WITH 3D-ULTRASOUND GUIDED CRYOABLATION OF THE PROSTATE</td>
<td>Harry Anastos</td>
</tr>
</tbody>
</table>
49 THE ROAD TO ROBOTIC MINI-PERCUTANEOUS NEPHROLITHOTOMY (PCNL): INITIAL CLINICAL EXPERIENCE OF PCNL COMBINING URETEROSCOPIC (URS) LITHOTRIPSY WITH SYNCHRONOUS PERCUTANEOUS EVACUATION OF FRAGMENTS

Mihir M. Desai

50 INITIAL REAL-WORLD EXPERIENCE OF URETEROSCOPIC LITHOTRIPSY USING THE LITHOVUE ELITE SYSTEM WITH INTRARENAL PRESSURE MONITORING CAPACITY

Kyochul Koo

51 FIRST-IN-SEAL KIDNEY STONE TREATMENT IN THE HARBOUR SEAL: RESULTS FROM COMBINED NOVEL BREAK WAVE LITHOTRIPSY AND URETEROSCOPY

Ben H. Chew

52 ANASTOMOSES IN SINGLE-PORT ROBOT-ASSISTED KIDNEY ALLOTRANSPLANTATION

Roxana Ramos

53 TOP 10 ABSTRACT

ASSIST-U: A SYSTEM FOR SEGMENTATION AND IMAGE STYLE TRANSFER FOR URETEROSCOPY

Daiwei Lu

54 INVESTIGATION OF BLADDER BIOMECHANICS USING URO-DYNAMIC MIR

Juan Pablo Gonzalez-Pereira

55 PROSTATE CANCER DIAGNOSIS WITH MICRO-ULTRASOUND – A PILOT CLINICAL STUDY

J. Pensa

56 HOW MUCH FORCE DO UROLOGISTS EXERT WHEN PLACING AN URETERAL ACCESS SHEATH?

Seyed Amiryaghoub M. Lavasani

57 ASSESSING THE ROLE OF AUGMENTED REALITY TECHNOLOGIES IN UROLOGICAL SURGICAL MISSIONS

Kevin Kunitsky

58 SIZE MATTERS – WHICH IMAGING MODALITY BEST PREDICTS ACTUAL RESECTION WEIGHT IN ROBOT-ASSISTED SIMPLE PROSTATECTOMY?

Timothy K. O'Rourke, Jr

59 BEST ABSTRACT AWARD

ENHANCED ASSESSMENT OF URODYNAMICS IN A PATIENT-SPECIFIC, IN VITRO MODEL OF THE BLADDER USING DYNAMIC 3D MRI AND PARTICLE IMAGE VELOCIMETRY

James Rice

60 TOP 10 ABSTRACT

NOVEL NANOPARTICLE COATINGS WITH ANTIBACTERIAL AND ANTIBIOFILM PROPERTIES

Juan Sebastian Rodriguez

61 DEVELOPING A MECHANICAL ANTIBIOTIC ALTERNATIVE TO PREVENT URINARY TRACT INFECTION

Maya Overland

62 PROSTATE VOXEL MODEL RECONSTRUCTION FROM TRACKED MICRO-ULTRASOUND IMAGES

Alejo Ballester

63 AN ANATOMY-BASED VAGINAL DILATOR AND HOME INSEMINATION DEVICE FOR CIS AND TRANSGENDER PEOPLE

Maurice Garcia

64 ROBOTIC FLEXIBLE URETEROSCOPY SYSTEM, ZAMENIX: EFFICACY AND SAFETY VALIDATION THROUGH CLINICAL TRIAL

Joonhwan Kim
<table>
<thead>
<tr>
<th>No.</th>
<th>Title</th>
<th>Presenter</th>
</tr>
</thead>
<tbody>
<tr>
<td>65</td>
<td>APPLICATION OF 3-DIMENSIONAL (3D) PRINTING TO PROTOTYPING A SURGICAL DEVICE: ENSURING RAPID PROGRESSION FROM CONCEPT TO CLOSURE</td>
<td>Matthew Polson</td>
</tr>
<tr>
<td>66</td>
<td>DEPENDENT LOOPS FOIL CHEST-TUBES AS THEY DO URINARY CATHETERS, BUT IN REVERSE! A SOLUTION FOR EARTH AND SPACE</td>
<td>Maurice Garcia</td>
</tr>
<tr>
<td>67</td>
<td>SHORTCOMINGS IN URINARY CATHETERIZATION TRAINING AND DEVELOPMENT OF A NEW GENERATION OF PHYSICAL TASK TRAINERS</td>
<td>Michaela Mullison</td>
</tr>
<tr>
<td>68</td>
<td>ALTERNATIVES TO THE HALF-HITCH FOR THE FIRST THROW IN SURGICAL KNOT TYING</td>
<td>Steven M Monda</td>
</tr>
</tbody>
</table>
ABSTRACTS

ABSTRACT #1

NOVEL ANTI-REFLUX “RELIEF” STENT TO PREVENT VESICOURETERAL REFLUX

Michael Callegari, Erin Jesse, Karishma Gupta, Kimberly Tay, Helen Sun, Nicholas Sellke, Irina Jaeger, Donald Bodner, Kyle Scarberry
Urology Institute, University Hospitals Cleveland Medical Center, Cleveland, OH, USA

Introduction: Ureteral stents notoriously cause bladder, flank discomfort, urgency, frequency, dysuria & hematuria; all likely related to stent-associated vesicoureteral reflux (VUR). This clinical trial assessed efficacy, comfort, & symptoms of a novel ureteral stent (RELIEF) that substitutes the distal semirigid coil of a traditional double-J (DJ) for a floating, monofilament tether allowing coaptation of the ureteral orifice (Figure 1). We hypothesized that this design would eliminate VUR, be safe & provide comfort following endourologic intervention.

Methods: Our single institution study screened 25 adult patients requiring unilateral endoscopic therapy & ureteral stent placement, 21 of which were enrolled & 19 having RELIEF stent placed. Passive cystography was performed pre- and post-stent placement to assess VUR. Patients were asked to complete the Ureteric Stent Symptoms Questionnaires (USSQ) before placement (baseline), post-operative day 1, and the day of stent removal (day 7).

Results: There were 11 female and 8 male patients (19 total) with 11 (58%) having undergone previous stent placement. Four and 15 patients had renal and ureteral calculi respectively. 100% of patients demonstrated no VUR before & after RELIEF stent placement. Two patients did not receive a RELIEF stent due to ureteral trauma & no patients experienced adverse complications; 1 patient opted for early stent removal due to significant discomfort. Average total USSQ scores were 77, 72 & 60 pre-stent placement, post-operative day 1, and on the day of stent removal, respectively, with improvement noted within the Urinary Symptom scores (U; 25 to 20). The USSQ scores amongst patients with previous stent in place were 73, 70, 65 at those time periods, respectively.

Conclusion: The RELIEF stent eliminates VUR with similar stent-related morbidity and overall well-tolerance. RELIEF associated USSQ scores were below published mean symptom scores for standard DJ stents and appear safe in this preliminary clinical trial.
ABSTRACT # 2

BURST WAVE LITHOTRIPSY OF OBSTRUCTING URETERAL STONES IN A DOLPHIN

Arturo Holmes,¹ Robert Laughlin,² Erica Kiewice,² David Blasko,² Jennifer Meegan,³ Jeff Thiel,⁴ Oren Levy,⁵ Michael R. Bailey¹,⁴
¹Dept. of Urology, University of Washington School of Medicine, Seattle, WA USA; ²The Mirage Hotel, Hard Rock International, Las Vegas, NV USA; ³National Marine Mammal Foundation, San Diego, California; ⁴Ctr. for Industrial and Medical Ultrasound, Applied Physics Lab., Univ. of Washington WA USA; ⁵SonoMotion, Inc., San Mateo, CA

Introduction: Kidney stones that grow over time to fill the kidneys are common is 30% of managed dolphins, such as those in the care of the U.S. Navy. A geriatric 48-year-old female dolphin was septic with a urinary stone obstruction. Her veterinarians did not feel she could survive anesthesia for ureteroscopy and could not locate a lithotripter if she could fit one. The team therefore attempted treatment with a human investigational device delivering burst wave lithotripsy (BWL).

Methods: BWL transcutaneously delivers sinusoidal ultrasound bursts to fragment stones optionally in combination with ultrasonic propulsion of lower amplitude longer durations bursts to reposition the stone fragments. Targeting and monitoring are performed with real-time ultrasound imaging within the same system. The dolphin was provided oral sedatives and was placed on a mattress out of the water on her side.

Results: The dolphin’s condition was improved by antibiotics and IV fluids in the 10 days from the initial request for BWL treatment. She still showed no interest in eating on her own and had dropped in weight from 500 to 450 pounds (204 to 227 kg). The right ureter and collecting duct of the dolphin’s reticulated kidney remained grossly dilated on ultrasound. A 1-cm stone had been mid ureter at the point the ureter crossed a vessel (similar to a point in humans where stones obstruct at the iliac vessels) with dilation proximally for 3 weeks and at the time of treatment a second 8-mm stone had joined it at the same point. Two treatments were attempted within 24 hours. The image appeared to show fragmentation. Fragments appeared to move within the ureter with ultrasonic propulsion. Imaging with a clinical ultrasound unit showed a flattening and elongation of collection of fragments. The dolphin was seen to be “hunching” that evening in a posture seen only in birth that indicated to all some discomfort and trying to pass stones. The next day these fragments had shifted caudally and on next view 8 days later the fragments were at the ureteral orifice (UO). Post-procedure day 9, the fragments were gone, but it was suspected the handling had loosened small left-sided stones that were visualized at the left UO. On day 11 all stones and dilation were gone, and the dolphin was eating on her own for the first time in over a month and was returned to the larger pool with the other dolphins. However, she never fully recovered and passed away about 5 weeks post-procedure from causes unrelated to kidney stones.

Conclusion: Within two weeks a dolphin with no other options went from discussion of euthanasia to a healthy return to her normal tank after treatment by investigational BWL and care by an expert veterinary team.

Acknowledgement: Dolphin care supported by The Mirage Hotel and development of BWL supported by NIH P01 DK043881.
IS IT SIZE OR FIRMNESS THAT MATTERS? EXAMINING DIFFERENT MINIATURE PERCUTANEOUS NEPHROLITHOTOMY ACCESS SCAEHTHS

Gregory Mullen¹, Tareq Aro¹, Arun Rai¹, David Hoenig¹, Zeph Okeke¹
¹The Smith Institute for Urology at Northwell Health

Introduction: Miniatu re Percutaneous Nephrolithotomy (mini-PCNL) can be done via a variety of different access sheaths. At our institution, we commonly use either a Storz® 15/16Fr metallic sheath (S16), a Storz® 16.5/17.5Fr metallic sheath (S17.5), or a Cook® 16Fr polytetrafluoroethylene peel away sheath (C16). Depending on location of access and torque, we noticed variations in the irrigation quality suggesting not only size, but firmness affect the integrity of the lumen of the sheath.

Methods: Using a silicone kidney model, access was obtained into a posterior interpolar calyx, simulating prone mini-PCNL. Using a Storz® 12Fr nephroscope, we measured the volume of irrigation evacuated from the various access sheaths over three-minute time intervals. We then placed the same ten 3 mm stone fragments into the renal pelvis and measured the number of passes and time required to remove the fragments via the vacuum cleaner effect.

Results: The average amount of irrigation evacuated from the access sheaths over 3 minutes was 640 ml, 670 ml, and 700 ml for the C16 , S16, and S17.5, respectively. The average number of passes required to remove the stones were 4.5, 4.5, and 11.5 for the C16, S16, and S17.5, respectively. When the C16 was intentionally kinked (Figure 1) the average number of passes to remove the stones increased to 7.5. The average time required to remove the stone fragments was 37.5 seconds with S16 compared to 32 seconds with C16. This increased to 77 seconds after C16 was kinked.

Conclusions: Although irrigation, stone clearance speed, and number of passes to remove stones did not differ between the sheaths, the integrity of the lumen dictated by the access and firmness of the sheath can decrease the ability to clear even small fragments. This suggests a softer peel away sheath is a viable option for mini-PCNL, but good planning and technique may be crucial to success.

Figure 1. Kinked sheath
ABSTRACTS

ABSTRACT # 4

VALIDATION OF A NOVEL KIDNEY PATHOLOGY PHANTOM DESIGNED FOR ULTRASOUND TRAINING FOR PERCUTANEOUS RENAL BIOPSY AND PELVIS PUNCTURE

Nelson Stone1, Grant Sherman2, Michael Wilson2, Jonathan Stone3

1Icahn School of Medicine Mount Sinai, NY, NY, 2Viomerse, Inc, Pittsford, NY, 3University of Rochester Medical Center, Rochester, NY

Introduction: Urologists, experts in prostate ultrasound, have not routinely performed renal biopsy or percutaneous access to the collecting system. We developed a model (phantom) to train clinicians in these two procedures.

Methods: A synthetic left flank including skin, muscle, spine, 3 ribs, kidney with upper and lower pole tumors, ureter and hollow renal pelvis and calyces with a partial staghorn calculus was created to teach ultrasound imaging, biopsy, and access to the collecting system (figure 1). The phantom was introduced for US training at a hands-on training course in PCNL. A 17-question survey was administered before and after practice with a transabdominal probe (BK 5000 with the 9085 5C1e transducer) to measure confidence in recognizing structures, performing biopsy and collecting system puncture. Comparisons were made by 2-tailed student t-test.

Results: 5 practicing urologists and 5 residents participated in the training and completed the survey. The mean number of years in practice was 7.3 (range 0-31) and the mean number of prior cases was 13.3 (range 0-50). Mean improvement in skills was 0.6 to 2.0 using a 5-point scoring system ranging from not at all confident (=1) to extremely confident (=5, figure 2). The mean score (range) for questions of how well the phantoms resembled performing the procedure on patients were: 1) the simulated tissue resembles texture and behavior of live tissue-3.7 (range 2-5), setup of the model with the medical device resembles patients-4 (3-5), practice with the system improves technical skills-4.6 (3-5), it is more effective than a cadaver-3.7 (2-5), it could be the preferred educational tool for this procedure-4.2 (3-5), it is valuable in an hands-on workshop-4.4 (2-5) and the system should be prerequisite before PCNL in patients-3.3 (2-5).

Conclusion: This investigation validated the new kidney pathology phantom as an effective model to train urologists on renal ultrasound including biopsy and US-guided collecting system puncture. Further testing in skills attainment is warranted.

Figure 1: Kidney pathology phantom. Figure 2: Change in confidence level prior to and after training.
DEVELOPMENT OF A MALE INSERTION METHOD FOR A CATHETER-FREE AMBLUATORY CYSTOMETRY DEVICE

Madison Lyon¹, Tyler Tevis², Adam Doelman³, Robert Hoey⁴, Steve Majerus², Margot Damaser¹, Ly Hoang Roberts¹

¹Glickman Urological and Kidney Institute - Cleveland Clinic; Cleveland, OH, USA; ²Advanced Platform Technology Center - Louis Stokes VA Medical Center; Cleveland, OH, USA; ³International Collaboration on Repair Discoveries, University of British Columbia, Vancouver, British Columbia, Canada; ⁴Department of Physical Medicine and Rehabilitation, MetroHealth; Cleveland, OH, USA

Introduction: Multichannel urodynamics (UDS) is the gold-standard method of quantitatively evaluating the lower urinary tract [1], however, performing UDS also poses numerous challenges, notably the requirement of specialized equipment and staff, and the creation of an artificial, uncomfortable environment during testing which may influence results [2]. We have developed a system and method for wirelessly monitoring bladder function in a less invasive and distressing manner, called the UroMonitor (UM). The UM is a wireless, transurethrally-inserted micromanometer containing a pressure transducer, a microbattery, and an integrated circuit with instrumentation, power management circuitry, and telemetry. This device has been tested in the first ever human subject trial which demonstrated the feasibility and safety of use in female patients, and the accuracy of generated pressure data [3]. Thus far, the UM has only been used in female patients due to the challenges of placing the device via the longer male urethra. In the present study, we sought to develop a technique for safely and reliably inserting the UM in male patients.

Methods: Three methods were developed for the insertion and deployment of the UM in male patients and were tested in human male cadavers. Method 1 included a 21 Fr silicone tube with a silicone molded coudé tip and exit channel for UM deployment (Figure 1-1). Method 2 included a 21 Fr silicone tube and the UM device with an attached silicone molded coudé tip (Figure 1-2). Method 3 included placement of a 21 Fr silicone tube under direct vision over a cystoscope and subsequent advancement and deployment of the UM through the tube under direct cystoscopic vision (Figure 1-3 and 1-4). X-ray fluoroscopy or cystoscopy was used to confirm successful UM deployment and assess for urethral trauma after insertion.

Results: Method 1 and 2 were unsuccessful in consistently allowing UM deployment in the male cadaver bladder due to buckling of the insertion tool at the level of the exit channel (method 1) and inconsistent ability to traverse the urethra atraumatically (method 2). Method 3 was 100% successful at allowing for atraumatic, and reproducible insertion across the urethra and deployment into the bladder in two male cadavers across 3-5 insertions per cadaver.

Conclusion: Insertion of the UM device is feasible and reproducible in male cadavers without evidence of urethral trauma using method 3. Further study needs to be performed in male patients.

Figure 1:
1. Method 1: 21Fr silicone tube and coudé tip attached with UM deployment via exit channel.
3. Method 3: standard UM deployment through distal tip of 21 Fr silicone tube with cystoscope as pusher.
4. Method 3: cystoscopic view of 21 Fr silicone tube in bladder (A), advancement of UM through silicone tube (B, C), UM deployment into bladder (D), and atraumatic urethra after insertion (E, F)
SECOND-LOOK FLEXIBLE URETEROSCOPY AFTER RIRS—HOLMIUM MOSES VERSUS TLF (SOLTIVE)

Geavlete B.¹,², Mareș C², Multescu R.¹,², Georgescu D.¹,², Geavlete P.¹,²
¹Sanador Hospital; ²“Saint John” Emergency Clinical Hospital, Department of Urology, Bucharest, Romania

Introduction: The retrograde intrarenal surgery (RIRS) is nowadays more and more indicated in pyelocaliceal stones. Holmium and Thulium lasers are the main lasers used. The fragmenting (basketing) or the dusting, despite the new technology, still have residual stones (even having 250 µm). This study evaluates the value of the second-look flexible ureteroscopy (SLfURS) for residual fragments comparing Holmium lithotripsy and TFL.

Material and methods: We analyzed 246 patients (between October 2020 and March 2022) for whom we used Moses Holmium technology, Dornier Medilas H35 (187 cases) – Group 1, and Soltive Laser System (59 cases) – Group 2. All cases were performed by three operators. In all cases, a CT urography was conducted to evaluate the anatomy of the urinary system and determine the stone density. The average stone size was 15.1 mm (range 11-33) and the average stone density was 1.026 HU (range 870-1.752). We used 270 μm for Ho:YAG laser and 150 μm for TFL. For Holmium, we used an energy of 0.4J and a frequency of 80 Hz. (dusting mode). For TFL we applied fine dusting (0.15 J/100 Hz) and dusting (0.5 J/30 Hz). The SLfURS was performed after a 3-month period of time in cases in which the CT scan found residual fragments over ≥ 4 mm. (median time to follow up CT was 4 weeks). An auxiliary laser lithotripsy procedure was performed to achieve a true stone-free status (residual stones less than 250µm).

Results: After the first procedure the stone-free rate at 3 months was 86.63% (n=162/187) in Group 1 and 96.61% (n=57/59) in Group 2. After the SLfURS the stone-free rate at 3 months was 95.18% (n=178/187) in Group 1 and 100% (n=59/59) in Group 2; however, we still found residual stones over 250 µm, after the SLfURS and in 9 cases following Holmium laser treatment. We didn’t find residual stones (over ≥ 4 mm.) after the SLfURS using TFL. We didn’t use Double J indwelling after the second procedure. Both groups were compared for completely visual stone-free rates and CT records and found to have a 97% similar evaluation.

Conclusions: From our experience, SLfURS could realize a significative reduction of the residual stone and achieve a real stone-free status. We found a slight difference between these two laser technologies, but SLfURS decreased the residual stone fragments.
ABSTRACTS

ABSTRACT #7

BILATERAL SAME-SESSION FLEXIBLE URETEROSCOPY FOR RENAL STONES: EFFICACY AND SAFETY

Geavlete B.1,2,3, Popescu R1,3, Mares C.1,3, Multescu R.1,2, Iordache V.1,2, Geavlete P.1,2
1Saint John Emergency Clinical Hospital, Department of Urology, Bucharest, Romania
2Sanador Hospital; 3Carol Davila University of Medicine

Introduction: A staged ureteroscopic procedure is the generally preferred method in the treatment of the bilateral renal stones. New technology (e.g., ureteroscopes, disposables and lasers) have reduced the risk of injury during the procedure. In this study we evaluated the safety and the efficacy of bilateral same-session flexible ureteroscopy (BS-fURS) in renal stones.

Material and methods: A total of 117 patients underwent bilateral BS-fURS between May 2014 and August 2022 for unique renal stones. The mean stone burden per patient was 33 ± 7 (range 21-41 mm). The average stone density was 1.240 HU (range 970 to 1.510). We used 4 types of ureteroscopes: Olympus URF-V2 (8.5 Fr.) – 43 cases, Storz Flex X2 (8.4 Fr.) – 40 cases, single-use PUSEN PU 3022 (9.5 Fr.) – 17 cases, and single-use PUSEN – PU 3033A (7.5 Fr.) – 7 cases. In all cases treated with the PU 3033A ureteroscope, we didn’t use an access sheath. A 10/12 Fr access sheath was used for the other cases. Our Holmium laser settings were for: dusting (low energy: 0.5J, high frequency: 50 Hz, long pulse), pop-dusting (medium energy: 0.5-1 J, high frequency: 50 Hz, long pulse), pop-corning (high energy: >1 J, medium frequency: 10-50 Hz, long pulse), and fragmenting (high energy: >1 J, low frequency: <10 Hz, short pulse). Mixed lithotripsy settings were necessary in 22% of the renal stone endoscopic treatment. The operative time, the stone-free rates (SFRs) per renal unit, the stone compositions, the number of procedures and the complications were evaluated.

Results: We found 51 calcium oxalate monohydrate cases, 27 calcium oxalate dehydrate cases, 17 uric acid cases, and 22 magnesium ammonium phosphate cases. The mean operating time was 77 min. (range 52 to 85) for both renal units. The SFRs were evaluated between 1 and 3 months with computed tomography; fragments > 1 mm were defined as residual. Bilateral residual fragments were found in 7/117 cases (6.07%) and unilateral in 24/117 cases (20.51%). Double J stenting (6 Fr) was applied bilaterally in 5 cases and unilaterally in 37 cases. The overall SFRs after 1 and 2 procedures were 73.5% (31/117 cases) and 95% (7/117 cases), respectively; a bilateral approach was necessary in only 1 case. After the second ureteroscopy was performed, we didn’t use the double J indwelling. Postoperative complications were Clavien I-II (47%) and Clavien III (17%). We didn’t describe any cases with Clavien IV and V. Urinary tract infections were observed in 41 cases (35%) without any case of urosepsis.

Conclusions: Our experience suggests some BS-fURS advantages as single anaesthesia session and a potentially reduction in cost associated with the treatment. BS-fURS seems to be feasible and safe, especially for medium-sized bilateral renal stones in high-volume centres. The complete dusting of the stones can avoid the need for ureteral stents, which reduces the patient’s discomfort. The proper selection of patients and an extending surgery on the second side only when the first side has been uneventful were the keys of success. This surgical attitude could actively change our standard practice in selected cases.
ABSTRACTS

ABSTRACT #8

VESICOURETHRAL ANASTOMOSIS IN TRANSVESICAL SINGLE-PORT ROBOTIC RADICAL PROSTATECTOMY (SP-RARP): A TECHNICAL DESCRIPTION AND PERIOPERATIVE OUTCOMES

Nicolas A Soputro, Roxana Ramos-Carpinteyro, Jaya S Chavali, Ethan L Ferguson, Jihad H Kaouk
Glickman Urological & Kidney Institute, Cleveland Clinic Foundation, Cleveland, OH

Introduction: The creation of a watertight vesicourethral anastomosis constitutes a critical, yet time-consuming step in robotic radical prostatectomy. With the introduction of transvesical approach using the purpose-built single-port robotic platform (SP-RARP), we sought to describe the technical evolution and perioperative outcomes of vesicourethral anastomosis in transvesical SP-RARP from a single institution.

Methods: A retrospective review was performed on 20 initial and most recent transvesical SP-RARP cases (n = 40) performed by a single surgeon. A summary of our technique using two unidirectional V-loc sutures was summarised in the Figure 1. Demographic, perioperative, and follow-up data were collected from the prospectively maintained database and statistical analysis was performed.

Results: The two groups were similar in their baseline clinical characteristics. The number of sutures for vesicourethral anastomosis was significantly less in the latest 20 cases (median: 13 vs. 15), with a significant reduction identified in the number of sutures for posterior anastomosis. Anastomosis time was also faster (median: 19.1 vs. 33.5 minutes) and constituted less portion of the total operating time (median: 11.5% vs. 14.7%) in the latest 20 cases. Furthermore, specimen weight and volume were significantly greater for the later cases (median weight: 45.1 vs. 37.6 grams; median volume: 40.9 vs. 36.2 mL). All procedures were completed successfully without the need for conversion or additional ports. There was no evidence of postoperative urine leak or other complications.

Conclusion: We provided a technical description for vesicourethral anastomosis in transvesical SP-RARP. Despite the larger specimens in our later cases, we identified a significant reduction in the number of sutures used for the anastomoses. The lower number of sutures contributed to quicker anastomosis and operating times while maintaining similar perioperative outcomes.

Figure 1. Technical description of vesicourethral anastomosis using two unidirectional V-loc sutures
ABSTRACTS

ABSTRACT #9

EFFICACY FOR ROBOT-ASSISTED FLUOROSCOPIC RENAL PUNCTURE IN MITIGATING LEARNING CURVE FOR PCNL

Kazumi Taguchi1, Teruaki Sugino1, Ryusuke Deguchi2, Shimpei Yamashita2, Rei Unno1, Shuzo Hamamoto1, Atsushi Okada1, Yasuo Kohjimoto2, Isao Hara2, Takahiro Yasui1

1 Department of Nephro-urology, Nagoya City University Graduate School of Medical Sciences
2 Affiliation Department of Urology, Wakayama Medical University

Introduction: We previously reported the efficacy of robot-assisted fluoroscopy-guided (RAG) puncture in percutaneous nephrolithotomy (PCNL)1. In the current study, we compared ultrasound-guided (USG) puncture with RAG puncture by 1) determining the learning curve for surgical outcome from a pooled clinical trial data, then 2) by using the improved version of robot system for percutaneous renal puncture (ANT-X®), which enabled us to perform horizontal puncture in the supine position (Figure 1).

Methods: 1) The surgical outcomes of RAG PCNL were analyzed to calculate the learning curve and then compared with the 300 USG PCNL database. 2) We conducted a multicenter prospective benchtop study with a renal phantom model using the improved version of ANT-X®. The participants were 17 urologists who punctured the renal phantom model using RAG and USG techniques. The single puncture success rates, time from device setup to puncture, puncture time, and fluoroscopic usage time were recorded, and the surgeon’s self-assessment using the NASA-Task Load Index was conducted for the analyses.

Results: 1) In the RAG group, the learning curve for percutaneous access duration and surgical time was steeper than that in the USG group. The stone-free rate and complications significantly improved as cases accumulated per resident in the USG group, whereas there was no statistical difference in these outcomes by case accumulation in the RAF group. 2) A total of 32 urologists participated in this study. The single-puncture success rates of the RAG and USG techniques were 91% and 56%, respectively (p < 0.01). In the RAG technique, the median device setup time was longer (146 and 25 s, p < 0.01), whereas the median needle puncture time (18 and 34 s, p < 0.01) and the deviation from the target center (16 and 26 mm, p<0.01) were shorter than those in the USG technique, respectively. The results of the surgeon’s self-assessment showed that the Mean Weighted Workload Score was lower in the RAG technique than in the USG technique (25 and 60, p < 0.01); the mental workload was significantly smaller in the RAG technique.

Conclusion: The RAG technique showed higher accuracy rates of puncture and smaller mental workload than the USG technique for renal puncture.

Figure 1. Phantom needle puncture was performed with the updated version of the device (ANT-X v2.0) for biplane mode puncture in the supine position.
ABSTRACT # 10

SAFETY AND FEASIBILITY OF THE CVAC™ CALCULUS VACUUM ASPIRATION CATHETER

Andrea Moyer, Luke Griffiths, Gregory Mullen, Leah Beland, Matthew Mikula, Tareq Aro, Jared Winoker, David Hoenig, Zeph Okeke, Arun Rai
Smith Institute for Urology, Northwell Health, New Hyde Park, NY, USA

Introduction: Nephrolithiasis is one of the most common urologic diseases with a prevalence up to 15% worldwide. While ureteroscopy with laser lithotripsy (URS) offers an effective minimally invasive approach, it is inferior to percutaneous approaches with regards to stone free rates (SFR), especially in patients with larger stone burden. The CVAC™ calculus vacuum aspiration catheter is a novel technology that uses irrigation and aspiration to remove small stone fragments after laser lithotripsy with the goal of achieving a surgically stone-free outcome.

Methods: From January through October 2022, the Calyxo CVAC device was used at Northwell Health hospitals. Patients were selected by surgeon preference. For initial cases, surgeons generally selected softer stones with smaller total stone burden and then increased size and complexity as they became more experienced. Computer tomography (CT) was utilized in all patients for preoperative surgical planning. Stone volumes were calculated for spheroids using formulas based on maximum stone diameter. Postoperative imaging was performed with either CT or ultrasound. Stone-free rate (SFR) was determined based on the definition in the Journal of Endourology: Grade A (no stones on CT scan) = absolute stone free; Grade B (<2 mm fragments) = relative stone free; and Grade C (2.1 – 4 mm) = not stone free.

Results: Thirty-nine patients underwent URS followed by CVAC aspiration. The majority of patients were pre-stented and had procedure performed unilaterally (Table 1). Average stone volume on non-contrast CT was 1158 ± 1291 mm³ with an average density of 903 ± 399 Hounsfield units (HU). Fluoroscopy averaged 110 ± 62 seconds per procedure. Post-operative imaging was performed in 26 patients, with 53.8% (7/13) achieving Grade A, absolute SFR, on CT. There were no intraoperative complications associated with CVAC use. Overall, there were five postoperative complications. Two patients (5.1%) developed postoperative sepsis, two patients developed urinary tract infections, and one patient had stent migration requiring return to the operating room for replacement. Six patients (15%) had second stage procedures to treat their stone disease.

Conclusions: CVAC is a novel technology, which achieved high SFR after URS in patients with large stone burdens. Although only 53.8% of patients were seen to have Grade A SFR, this is likely an underestimate as 1/3 of patients in our series underwent ultrasound evaluation with most (61.5%) having no visible fragments. While randomized trials are needed, this technology may be beneficial in patients with large stone burdens who elect to proceed with URS.

<table>
<thead>
<tr>
<th>Table 1. Baseline demographics and procedure outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Patients</td>
</tr>
<tr>
<td>Age</td>
</tr>
<tr>
<td>Female</td>
</tr>
<tr>
<td>Male</td>
</tr>
<tr>
<td>BMI</td>
</tr>
<tr>
<td>Pre-Stented</td>
</tr>
<tr>
<td>Stone Number, N</td>
</tr>
<tr>
<td>Single</td>
</tr>
<tr>
<td>Multiple</td>
</tr>
<tr>
<td>Total Stone Burden (mm³)</td>
</tr>
<tr>
<td>&gt;524mm³ = 1cm spherical</td>
</tr>
<tr>
<td>Stone Density (HU)</td>
</tr>
<tr>
<td>Fluoroscopy Time (seconds)</td>
</tr>
<tr>
<td>Post-op imaging</td>
</tr>
<tr>
<td>Ultrasound, n</td>
</tr>
<tr>
<td>Residual stone fragments, n</td>
</tr>
<tr>
<td>0</td>
</tr>
<tr>
<td>2-4mm</td>
</tr>
<tr>
<td>&gt;4mm</td>
</tr>
<tr>
<td>CT, n</td>
</tr>
<tr>
<td>Residual stone fragments, n</td>
</tr>
<tr>
<td>0</td>
</tr>
<tr>
<td>0 to 2 mm</td>
</tr>
<tr>
<td>2.1 to 4mm</td>
</tr>
<tr>
<td>&gt;4mm</td>
</tr>
</tbody>
</table>

(SFR) Stone free rate; CVAC = Calculus vacuum aspiration catheter; BMI = Body mass index; CT = Computed tomography; Hounsfield units
All continuous variables are presented as mean ± standard deviation.
ABSTRACT # 11

A RANDOMIZED CONTROLLED TRIAL OF TRUS-ROBOT VS. URONAV BIOPSY IN THE DIAGNOSIS OF CLINICALLY SIGNIFICANT PROSTATE CANCER, PRELIMINARY RESULTS

Michael E. Rezaee, Katarzyna J. Macura, Bruce Trock, Doru Petrisor, Arthur L. Burnett, Amin Herati, Christian Pavlovich, Misop Han, Dan Stoianovici

1Urology, 2Radiology, and 3Robotics Laboratory Departments, Johns Hopkins University

Introduction: Significant discrepancy exists between sextant template targets and the location of actual cores obtained by urologists during freehand systematic MRI prostate biopsy (SB) [PMC3876458]. Despite the benefits of targeted biopsy (TB) using multiparametric MRI (mpMRI) [PMC26237632], SB still detects about 6-12% of clinically significant prostate cancers (csPCa) that may be MR-invisible [PCM35507051] or missed at TB. Transrectal ultrasound robotic-assisted (TRUS-Robot) biopsy is a novel method to diagnose prostate cancer by using a robotic ultrasound probe manipulator investigational device (Figure 1) [EUS2017 Abs.34, PMC4005376] and three-dimensional navigation software to optimize the location of biopsy cores. Prior research has shown that TRUS-Robot biopsy is feasible, safe, more uniformly samples the prostate gland, and may detect more csPCA’s compared to freehand prostate biopsy [EUS2018 Abs.43, PMC6726124, EUS2022 Abs.36]. We hypothesized that TRUS-Robot would be superior to UroNav (Philips/Invivo) on SB, and noninferior to TB in the detection of csPCa.

Methods: A single-center, open-label, randomized-controlled trial of TRUS-Robot versus UroNav prostate biopsy in men ages 45 to 75 with an indication for prostate biopsy and mpMRI imaging. All men underwent 12-core SB. On the UroNav arm the SB plan followed the extended sextant biopsy template; On the Robot arm the SB plan was optimized for each patient [PMC27760001]. On both arms, if PI-RADS Ver.2 lesions scored 3-5 were identified on mpMRI, the lesions were targeted with the respective device and 3 cores were sampled per lesion. For comparison to TB a noninferiority margin of 9% was selected.

Results: To date, 41 men have enrolled and undergone prostate biopsy: 24 TRUS-Robot and 17 UroNav; PI-RADS Ver.2 scores 3-5 were identified in 16 and 15 patients, respectively. For SB, a greater proportion of men have been diagnosed with csPCa in the TRUS-Robot (25%) compared to the UroNav (18%) arm of the trial (p=0.25). For TB, the TRUS-Robot was noninferior to UroNav with a greater proportion of men diagnosed with csPCa in the TRUS-Robot (38%) compared to the UroNav (20%) (p=0.048). In this case, the upper 90% confidence limit for UroNav csCDR – Robot csCDR was 0.03, indicating the Robot may be at most 3% worse than UroNav, well within the noninferiority margin of 9%. Overall, based on SB or TB cores, more men have been diagnosed with csPCa in the TRUS-Robot (38%) compared to the UroNav (24%) arm (p=0.13). In PI-RADS 3-5 patients, based on the SB or TB cores, csPCa was detected in 56% vs 27% of patients for the Robot vs. UroNav (p=0.19). Statistical significance has yet to be achieved. Average biopsy sampling times were 9.2 and 9.0 minutes for the Robot and UroNav arms, respectively. No complications or adverse events were recorded on either arm of the study.

Conclusion: Preliminary results are encouraging and suggest superior detection of csPCa by TRUS-Robot compared to UroNav. The trial continues to accrue.

Disclosure: Under a license agreement between Eigen Health Services and the Johns Hopkins University, authors DS, DP, and the University are entitled to royalty distributions related to technology described in this article. This arrangement has been reviewed and approved by the Johns Hopkins University in accordance with its conflict-of-interest policies.

Acknowledgment: Research reported in this publication is supported by the National Cancer Institute of the National Institutes of Health under award number R01CA247959, PI Stoianovici.

Figure 1: Robotic Ultrasound Probe Manipulator
**ARTIFICIAL INTELLIGENCE FOR AUTOMATED SEGMENTATION OF PROSTATE CANCER AND PELVIC ANATOMY**

Sakina Mohammed Mota¹, Joshua Shubert¹, Alan Priester¹,², Tom Summers¹, Matthew Salvador¹, Shyam Natarajan¹,²

¹Avenda Health, Inc. ²David Geffen School of Medicine, Department of Urology

**Introduction:** A reliable distinction of anatomy within and adjacent to the prostate is critical for diagnosing and treating prostate cancer (PCa). Manual localization of pelvic anatomy and PCa is tedious, subjective, and often inaccurate due to variability in prostate MRI scans. Hence, we developed artificial intelligence (AI) models to segment pelvic anatomy and cancer automatically and effectively.

**Methods:** AI-based PCa region of interest (ROI) and pelvic anatomy segmentation was performed using a nnUNet architecture. The PCa ROI segmentation model was trained using 1500 mpMRI cases (obtained from the 2022 “PRI-CAL” challenge) and their corresponding AI-predicted zonal anatomy labels as inputs. All PCa ROI labels had a PI-RADS score ≥ 4. Four additional AI models were trained individually using 912, 89, 833, and 332 T2W MRI cases for automated segmentation of prostate zones, pelvic bone, urethra, and other structures, respectively. Prostate zones consisted of the peripheral zone (PZ), central zone (CZ), and anterior fibromuscular stroma (AFS). Other structures included the rectum, bladder, and seminal vesicles (SV). Training labels for pelvic anatomy were manually defined using ITK-SNAP and 3D Slicer. All models were trained using 5-fold cross-validation and independently tested on 25 “Prostate158” challenge cases. ROI, PZ, and CZ test set labels were derived from Prostate158, and all others were manually generated by three imaging scientists. Another senior imaging scientist reviewed all test data.

**Results:** AI models achieved DICE score and max Hausdorff distance (mm) means of [84%, 2.5] for PZ, [91%, 3.0] for CZ, [63%, 3.4] for AFS, [99%, 0.2] for bladder, [97%, 2.0] for bone, [96%, 3.8] for rectum, and [77%, 4.4] for SV. Mean and max centroid distances (CD, mm) for urethra segmentation were 1.92 and 7.42. Lastly, the AI model segmented PCa ROIs with an AUC of 0.83 and 42% average precision.

![Exemplary image (independent test case 11) showing AI performance for automated segmentation of prostate cancer and pelvic anatomy (prostate zones, pelvic bone, urethra, rectum, bladder, and SV) compared to ground truth.](image)

**Conclusion:** AI can accurately and automatically segment pelvic anatomy and prostate cancer, potentially streamlining prostate cancer management. Among many potential applications, this could improve cancer diagnostic accuracy and help clinicians avoid damage to critical structures during interventions.
ABSTRACT # 13

EVALUATION OF RENAL FUNCTION AND STENT DURABILITY FOLLOWING RESONANCE STENT PLACEMENT FOR BENIGN DISEASE

Rohit Bhatt, Kelvin Vo, Andrei D. Cumpanas, Kalon L. Morgan, Andrew Shin, Sohrab N. Ali, Allen Rojhani, Akhil Peta, Andrew Brevik, Zachary E. Tano, Pengbo Jiang, Roshan M. Patel, Ralph V. Clayman, and Jaime Landman
Department of Urology, University of California, Irvine – Orange, California, USA

Introduction: The metallic Resonance stent (RS) is most commonly placed in patients with malignant ureteral strictures, but it can also be used in cases of a chronic benign ureteral obstruction (BUO). For such patients, however, the long-term impact of a RS on renal function has yet to be assessed.

Methods: We retrospectively evaluated BUO patients who underwent RS placement at our institution from 2010-2020. The impact of RS placement on renal function was studied by comparing pre-placement and long-term post-placement serum creatinine, eGFR, furosemide renal scans, and CT-based renal parenchymal volume measurements. Additional recorded metrics included the number of RS exchanges, encrustation incidence, average indwell time, and cost-effectiveness of RS placement versus polymeric stenting.

Results: At a mean follow up of 26 months (range 3-134), there was no change in eGFR (p = 0.99), parenchymal volume (p = 0.44), or split renal function of the stent-bearing side on renal scan (p = 0.48) (Table 1). Patients underwent a RS stent replacement an average of 1.1 times with a mean RS indwell time of 9.7 months (range 3-33). Eleven patients (26%) underwent premature stent replacement (6 cases) or removal (5 cases) (i.e., within 6 months of placement). Out of the 28 patients with comments on encrustation in the operative note, nine (32%) had an encrusted RS at time of replacement or removal, among whom, four (44%) required laser lithotripsy. The mean indwell time for the encrusted RS group was 12.5 months (range 5-23). Overall, 12 patients (28%) had an average RS indwell time of ≥ 12 months. Based on our institution’s data, there was a 5.6%, 37% or 52% cost reduction by using a RS compared to 2, 3, or 4 polymeric stent exchanges per year, respectively (Table 1).

Conclusion: At our institution, Resonance stent placement for benign ureteral obstruction resulted in successful long-term preservation of renal function and parenchymal volume during a mean follow-up of 2.2 years. Mean indwell time was 9.7 months, making the Resonance stent a cost-effective alternative to stenting with a polymeric stent.

Table 1. Summary of Resonance stent (RS) placement in setting of benign ureteral obstruction.

<table>
<thead>
<tr>
<th>Demographics</th>
<th>n = 43</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years), mean ± SD</td>
<td>62.7 ± 14.2</td>
</tr>
<tr>
<td>BMI (kg/m²), mean ± SD</td>
<td>28.0 ± 6.8</td>
</tr>
<tr>
<td>Gender (male), n (%)</td>
<td>20.0 (47)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Comorbidities</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Charlson Comorbidity Index (CCI), median ± SD</td>
<td>3.9 ± 2.7</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Preoperative Hydronephrosis, n (%)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>8 (19)</td>
</tr>
<tr>
<td>Yes</td>
<td>35 (81)</td>
</tr>
<tr>
<td>Unspecified</td>
<td>5 (12)</td>
</tr>
<tr>
<td>Mild</td>
<td>5 (12)</td>
</tr>
<tr>
<td>Moderate</td>
<td>7 (16)</td>
</tr>
<tr>
<td>Severe</td>
<td>18 (42)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Postoperative</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Follow-up (months), mean ± SD</td>
<td>25.8 ± 24.9</td>
</tr>
<tr>
<td>Number of RS Replacements During Follow-up, mean ± SD</td>
<td>1.1 ± 1.4</td>
</tr>
<tr>
<td>Average Duration of Indwelling Stent (months), mean ± SD</td>
<td>9.7 ± 6.2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Estimated Glomerular Filtration</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Preoperative (mL/min/1.73m²), mean ± SD</td>
<td>60.4 ± 25.8</td>
</tr>
<tr>
<td>Postoperative (mL/min/1.73m²), mean ± SD</td>
<td>60.3 ± 25.0</td>
</tr>
<tr>
<td>p-value</td>
<td>p = 0.99</td>
</tr>
<tr>
<td>Split Renal Function</td>
<td>n = 13</td>
</tr>
<tr>
<td>Preoperative Split Function (%)</td>
<td>42.9 ± 21.9</td>
</tr>
<tr>
<td>Stent-Bearing Kidney, mean ± SD</td>
<td></td>
</tr>
<tr>
<td>p-value</td>
<td>p = 0.48</td>
</tr>
<tr>
<td>Postoperative Split Function (%)</td>
<td>46.6 ± 27.6</td>
</tr>
<tr>
<td>Stent-Bearing Kidney, mean ± SD</td>
<td></td>
</tr>
<tr>
<td>Kidney Volume</td>
<td>n = 21</td>
</tr>
<tr>
<td>Preoperative (cm³), mean ± SD</td>
<td>134.1 ± 61.0</td>
</tr>
<tr>
<td>Postoperative (cm³), mean ± SD</td>
<td>127.4 ± 71.4</td>
</tr>
<tr>
<td>p-value</td>
<td>p = 0.44</td>
</tr>
<tr>
<td>Exchanges/year</td>
<td>RS associated cost-reduction compared with polymeric stents (%)</td>
</tr>
<tr>
<td>1 exchange/year</td>
<td>-8.8%</td>
</tr>
<tr>
<td>2 exchanges/year</td>
<td>5.6%</td>
</tr>
<tr>
<td>3 exchanges/year</td>
<td>37%</td>
</tr>
<tr>
<td>4 exchanges/year</td>
<td>52%</td>
</tr>
</tbody>
</table>

SD = standard deviation
INTRODUCTION: Since 2019 low intensity shockwave therapy (LiSWT) has been used to treat erectile dysfunction in the flaccid state by inducing mechanotransduction. The greater the shockwave energy absorbed in cavernosal erectile tissue, the greater the opportunity for mechanotransduction regenerative mechanisms to occur and improve erectile function. LiSWT effectiveness depends, in part, on applied energy (mJ/mm²) and number of applications (total shocks). While intensity of LiSWT energy cannot be arbitrarily increased due to side effects, energy absorption may be improved by performing treatment to an erect vs flaccid penis. Intracavernosal pressure and penile volume are both determinants of velocity of the energy wave in tissue and therefore absorption of shockwave energy in tissue. Since intracavernosal penile pressure when erect (100 mmHg) is 16-fold higher than flaccid (6 mmHg), and blood volume when erect (142.6 cm³) is >2 times more than flaccid (62.18 cm³), LiSWT in the erect state with larger blood-filled lacunar spaces should be associated with greater shockwave energy absorption. The aim of this study was to perform a simulation of energy absorption during LiSWT in the flaccid and erect penis.

METHODS: This research used the MTS UroGold electrohydraulic shockwave device [Softwave TRT]. When sound waves pass through an interface between 2 media with different impedances, sound propagation can be significantly altered. If impedances of the media are different, part of the sound energy is reflected into the incident medium; the rest of the sound energy is transferred to the second medium. Sound propagation in tissue can be illustrated via computer simulation by mathematically calculating the damping and deflection of the sound wave by different tissue structures. Finite Element Method (FEM) simulation models are particularly suitable for the mathematical description of complex processes of shockwave propagation, such as in the flaccid and erect penis. Based on results, a "prediction" of propagation of LiSWT in tissue is possible. This patient-specific procedure is based on consideration of individual anatomical structures: corporal lacunar spaces and physical-acoustic laws. For FEM modelling of LiSWT propagation, program systems ANSYS, MATLAB and PZFLEX/ONSCALE were used.

RESULTS: Using the FEM calculation model of the simulation analyses, the shockwave pulse is applied at the bottom edge of the model (Fig 1) and propagates through the erect (Fig 2a) and flaccid (Fig 2b) states, with the most energy absorption in the erect penis, shown in red. Fig 3 shows the effect of increased penile pressure on energy absorption when the volume is constant.

CONCLUSION: More energy is absorbed in cavernosal tissue during erection than in the flaccid state, with greater opportunity for beneficial mechanotransduction regenerative mechanisms. This is due, in part, to increased intracavernosal pressure and tissue volume with larger blood-filled lacunar spaces during erection. LiSWT to treat erectile dysfunction should be more effective when performed in the erect state.
ABSTRACT # 15

A BENCHTOP KIDNEY MODEL FOR MEASURING INTRARENAL PRESSURE DURING SIMULATED URETEROSCOPY

Alycia Abbott, Jessica Williams, Candace Rhodes, Todd Robida, Troy Velazquez, Aditi Ray
Boston Scientific, Inc

Introduction: Increased pressures in the upper urinary tract during endourological procedures are suspected to increase post-operative complications [1, 2]. Several factors have been identified that may influence intrarenal pressure (IRP) during ureteroscopy (URS) including use of a ureteral access sheath (UAS) [2], the ureteroscope OD: UAS ID ratio [3], presence of instrumentation [4], and irrigation flow rate [5]. Here we present a benchtop model that enables study of IRP during simulated ureteroscopy performed using a prototype single-use digital flexible ureteroscope with pressure monitoring technology.

Methods: The Boston Scientific Bench (BSB) kidney model consists of a chamber (with a 3-D printed kidney “calyx” insert) ringed by sensors with outflow paths available through incorporation of a UAS or through use of valves. The BSB also supports inclusion of stones or injection of fluid to create impaired visualization scenarios. The chamber walls may be changed from rigid plastic to flexible silicone to evaluate the impact of kidney compliance. Experiments were conducted with/without a UAS (10/12F, 11/13F), with/without a tool in the working channel (1.3F Flexiva™ 200 Laser Fiber, 1.9F Zero-Tip™ Basket) and with irrigation provided by gravity bag (30-100 cmH2O), pressure bag (150-300 mmHg), or with an automated pressure pump (30 –300 mmHg). The IRP during irrigation was monitored through use of the prototype pressure monitoring ureteroscope as well as a reference pressure transducer in a fixed location in the kidney model chamber. Additional data collection enabled by this model includes inflow rate, outflow rate, and temperature. Subsequent analysis of inflow/outflow rates and IRP allows for calculation of inflow/outflow resistances.

Results: The BSB supported steady-state irrigation flow resulting in a steady state IRP across all test scenarios. Use of a UAS or a tool in the working channel resulted in a reduction of IRP which agrees with previous literature results [4]. Additionally, the IRP increased as irrigation pressure increased, as has been previously reported [5]. Steady state IRP values from the BSB compare favorably to IRP values obtained with and without a UAS in a porcine preclinical model (Figure 1). The current BSB set-up allows coverage of the reported IRP ranges from similar model set-ups [3, 5].

Conclusion: IRP values produced by this model were similar to those measured from a preclinical porcine model and covered the same ranges reported from existing bench models. The BSB model supports simulated URS irrigation scenarios and allows investigation of the impacts of UAS use, scope:UAS ratio, instrumentation, and irrigation setting on IRP. The BSB is a useful tool which can help characterize the relationships between pressure, flow rate, and temperature during ureteroscopy procedures.

Acknowledgement: The authors would like to thank BSC employees Tony Soukalopoulos and Jeffrey Meganck for their contributions to the development of this model. Disclaimers: Prototype ureteroscope used in this study was a concept device/technology, which was not available for sale at the time the study was conducted. Bench testing results may not necessarily be indicative of clinical performance. Testing was performed by Boston Scientific. Data on file.

Figure 1: Example pressure data from prototype ureteroscope collected from the BSB model and a preclinical porcine model with an 11/13F UAS in place. BSB data presented as mean ± SD (N = 3). Preclinical porcine data is N =1.
ABSTRACT # 16

INITIAL CLINICAL EXPERIENCE OF A HIGH-DEFINITION SINGLE-USE FLEXIBLE CYSTOSCOPE

Zachary Kornberg¹, Eugene Shkolyar¹, Timothy J. Lee¹, and Joseph C. Liao¹,²
¹ Department of Urology, Stanford University School of Medicine, Stanford, CA 94305, USA.
² Veterans Affairs Palo Alto Health Care System, Palo Alto, CA 94304, USA

Introduction and Objective: Portable single-use cystoscopes are attractive alternatives to standard reusable cystoscopes as they require less capital investment, reduce contamination risks related to reprocessing, require less ancillary equipment, and are more amenable for efficient deployment in urgent clinical environment such as the emergency department. Here we present our initial experience with a new single-use, high-definition (HD) flexible cystoscope system in the clinic.

Methods: The UroViu (Los Altos, California) is a battery-powered cystoscope composed of a reusable handle and a disposable scope cannula (Figure 1A). The pistol-grip handle is reusable, with an integrated 4.3” LCD touchscreen, a 2-hour battery, and the capability to capture still images and video recordings. A 16.5 Fr sterile single-use cannula attaches to the reusable handle with a 1280 x 720 resolution sensor, two 6.6 Fr working channels, and 340° range of deflection (210° up and 130° down). A realistic bladder model (Lazarus 3D, Albany, Oregon) was used by the urologists for hands-on ex vivo training prior to first use. With informed consent, patients undergoing clinic cystoscopy at VA Palo Alto Health Care System were recruited. A standard digital cystoscope (Olympus CYF-VH HD) was available as backup. Cystoscopy images and videos were recorded for intra-patient comparison of image quality with available prior recorded cystoscopy videos.

Results: To date, 6 patients (age range 57 to 88 years; 5 male, 1 female) underwent clinic cystoscopy with single-use cystoscope by 3 urologists. Indications included bladder cancer surveillance (n=5) and ureteral stent removal (n=1). The hybrid model of reusable handle with a single-use canula allowed for rapid patient turnover within a normal clinic workflow. Five procedures were completed without issues. One procedure was aborted due to technical issue (low battery) and completed without incident with the standard cystoscope. The disposable cystoscope maneuverability was sufficient to view all regions of the bladder including retroflexion to evaluate the bladder neck. Subjective patient experience was solicited, with no reported change in procedure comfort compared to prior experiences. The image quality of the UroViu cystoscope was sufficient to identify suspicious bladder lesions (Fig 1B) in 2 patients who subsequently underwent TURBT. Figure 1C shows side-by-side comparison of a lateral bladder erythema visualized using the Olympus digital cystoscope 4 months prior and UroViu cystoscope, showing comparable image quality between the two HD systems. The patient had negative cytology and the lesion was confirmed to be granulomatous cystitis.

Conclusions
In an initial case series, the image quality, maneuverability, and patient experience of the UroViu HD single-use cystoscope were comparable to standard reusable cystoscopes. With its ease of set-up and integration into clinical practice, this portable single-use flexible cystoscope may be a useful, cost-effective tool in multiple clinical settings.
ABSTRACT # 17

PROTOTYPE DEVELOPMENT FOR NOVEL DEVICE TO PREVENT URETHRAL TRAUMA ASSOCIATED WITH ACCIDENTAL CATHETER REMOVAL

Tova Weiss, MD¹, Joelle Tudor², Michael Malone², Manny Pacheco², Liam Sullivan², Robert Sweet, MD¹, Jonathan Posner, PhD²
¹Departments of Urology and ²Mechanical Engineering at University of Washington

Introduction: One in four hospitalized patients require a urinary catheter during their stay[1, Pg.23]. Patients with altered mental status often attempt to remove their own catheters, or the tubing can be accidentally snagged during patient transport. The catheter balloon is at risk of being pulled through the bladder neck causing urethral trauma, hematuria, and potential long-term damage[2, Pg.1]. The incidence of accidental catheter removal (ACR) in the ICU is 2-5%[3, Pg.231]. The current solutions to prevent ACR are wrist restraints or constant nurse supervision, which increases patient agitation and is resource intensive, respectively [4, Pg.5]. We present the development and evaluation of a catheter breakaway device which allows the catheter tubing to disconnect and release external tubing at a specific force. The device meets the requirements of: custom placement position, simple and quick installation, fit standard catheter sizes, release force below the documented tissue-injury force of approximately 41.3N[5, Pg.1113], maintenance of balloon inflation and urine flow, and low cost to manufacture.

Methods: The device disconnection force was tested using an axial force gauge (.01N±1%). The flow rates through the catheter lumen were evaluated with the breakaway device installed compared to the standard catheter, in reference to ISO 20696-2018 requirements of 100 mL/min. The catheter function, maintenance of balloon volume, and potential leakage were evaluated over a duration of 30 days. User tests were performed by nurses and physicians by presenting an instructional video, and then performing device installation. An anonymous survey of the device necessity and design concept was completed.

Results: The disconnecting mechanism of the breakaway device had an axial force mean 12.9N (SD 3.3N) which is under the documented tissue-injury force but high enough to prevent frequent unnecessary disconnections. Flow through the urine lumen of a 16Fr latex catheter was on average 350 mL/min both with and without the device. The device features were validated by over 50 healthcare professionals. Preliminary user tests demonstrated successful installation in under 2 minutes for all users. 90% (10/11) of survey respondents stated that the device was helpful or very helpful to solve this problem, and 81% (9/11) stated that they were likely or very likely to use the device. Based on current 3D printing methods, device production cost estimates are less than $3 to produce.

Conclusion: The standard foley catheter can cause trauma to the urethra if it is removed with the balloon inflated. This breakaway device prevents injury by allowing the distal tubing to disconnect prior to tissue damage. The proximal portion of the catheter remains in place; therefore, the function of the current urinary catheter is maintained. We have received positive feedback about the clinical need and usability of the breakaway device. Funding has been provided through translational research grants, and an international patent has been filed. Future steps include product development for manufacturing optimization and clinical testing.

Figure 1: Breakaway device installed on foley catheter. Figure 2: Close-up view of breakaway device. Figure 3: Disconnect demonstration on a model.
3-DIMENSIONAL SHOCKWAVE MODELING OF SECONDARY REFLECTORS IN LOW INTENSITY SHOCKWAVE THERAPY FOR ED

Irwin Goldstein¹, Hannah Janout², Jonas Flatscher², Alyssa Yee¹, Cyrill Slezak²,³
¹San Diego Sexual Medicine, ²Ludwig Boltzmann Institute for Traumatology, ³Utah Valley University

Introduction: Induced pulmonary capillary hemorrhage due to enhanced tensile wave amplitudes in the vicinity of large impedance mismatches has long been associated with potential tissue damage. Ultrasound based mechanical index thresholds provide tissue-safety parameters that are evaluated based on the utilized shockwave applicator technology. Electrohydraulic generators have long been associated with large volumetric treatment zones and small tensile wave strength. The aim of this study is to show that use of a symmetry-matched secondary reflector in the therapeutic treatment of the penis in men with erectile dysfunction (ED) can not only reduce the appearance of further induced tensile stress forces, but also increase the treatment volume of each applied shockwave.

Methods: 3-dimensional numerical non-linear shockwave modeling is used to evaluate the pressure field distributions during the application of low intensity shockwaves therapy (LiSWT) to the penis for ED (Figure 1). Using water bath reference and phantom-based in-situ hydrophone sound pressure measurements, a systematic evaluation of a therapeutic application may be performed. A detailed knowledge of the soundwave propagation allows for evolutionary strategy-based optimization of ideal reflector geometries.

Results: Therapeutic longitudinal shockwaves reflected at the lateral end of application undergo phase-inversion at the air interface, resulting in the local creation of an enhanced tensile wave surrounding the boundary. The geometry of the genitalia creates a collecting reflection, but due to the symmetry and phase mismatches, no significant refocusing occurs at this secondary reflector. The addition of an applicator-matched reflector removes the enhanced tensile wave inside the treatment zone and provides a successive tertiary pulse of intensity between that of the insignificant primary and strongest secondary wave pulse. Figure 2 shows tensile pressures of 3-dimensional numerical non-linear shocks during LiSWT utilizing a reflector placed behind the penis with (Fig 2a) a layer of air and (Fig 2b) a layer of water acting as a buffer zone for potentially damaging tensile waves. The tensile pressure content inside the penis is significantly lower in 2b than 2a.

Conclusion: In LiSWT for ED much of the applicator’s focal zone may extend past the penis. The targeted use of a reflector may i) reduce tissue stress due to tensile forces and potential damaging cavitation effects, and ii) enhance size of treatment volume of a single pulse by refocusing the tertiary wave in rapid succession of the main treatment pulse. Thus, use of a water-filled symmetry-matched secondary reflector in LiSWT for ED should result in enhanced therapeutic efficacy.

![Figure 1. LiSWT with air reflector.](image1)

![Figure 2. Tensile pressures utilizing a reflector filled with air (2a left) and water (2b right).](image2)
ABSTRACTS

ABSTRACT # 19

COMPUTATIONAL FLUID DYNAMICS OF BLADDER VOIDING USING 3D REAL-TIME MRI

Labib Shahid¹, Juan Pablo Gonzalez-Pereira¹, Cody Johnson², Wade Bushman³, Alejandro Roldan-Alzate¹²⁴

¹ Department of Mechanical Engineering, University of Wisconsin-Madison; ² Department of Radiology, University of Wisconsin-Madison; ³ Department of Urology, University of Wisconsin-Madison; ⁴ Department of Biomedical Engineering, University of Wisconsin-Madison

Introduction: Multi-channel urodynamic studies are performed to measure bladder pressure and flow during voiding. They are often done in men to assess the contributions of bladder outlet obstruction and/or diminished contractility to impaired bladder emptying [PMC6719661]. We present a patient-specific MRI-based computational fluids dynamics (CFD) method to characterize bladder voiding in a young healthy man.

Methods: In-vivo MRI study was performed in one male volunteer (29 years old) with no history of benign prostatic hyperplasia (BPH) following an IRB-approved HIPAA-compliant protocol. The subject was scanned on a clinical 3T scanner. Volumetric dynamic images were acquired while the subject voided in the scanner. The bladder and urethra were segmented, and 3D models were generated at each time point of the voiding event. The volume of the bladder at each time point was used to calculate the urine flow rate. This flow rate was imposed in a set of steady-state CFD simulations of the urethra to calculate pressure at the bladder neck. We developed a script that processes the surface of the bladder wall such that the surface mesh at all time points have the same mesh topology. The processed bladder walls were used to define the wall motion as an input for the CFD simulation of the bladder voiding. The bladder neck pressure calculated from the urethra simulation was imposed as the outlet boundary condition. The bladder simulation calculated the detrusor pressure which was used to calculate bladder outlet obstruction index (BOOI) and bladder contractility index (BCI).

Results: 3D real-time MR images of the bladder and urethra were acquired during voiding. Urethra and bladder CFD simulations were successfully executed following the methodology described above. The detrusor pressure and velocity contours from the bladder simulation are shown in the figure. The maximum flow rate, Qmax, was 13.1 mL/s, and detrusor pressure at maximum flow rate, PdetQmax, was 6.6 cmH2O. These values were used to calculate a BOOI of -19.6, and BCI of 72.1, indicating an absence of obstruction and moderately diminished bladder contractility.

Conclusion: This is to our knowledge the first use of 3D real-time MRI to perform a subject-specific CFD simulation of a voiding. This methodology allows voiding pressure and flow as well as metrics of obstruction and contractility to be obtained in a non-invasive manner.

Figure 1. Plot of detrusor pressure (left), and CFD results from bladder simulation (right).
PERIOPERATIVE OUTCOMES AMONG SINGLE-PORT AND MULTI-PORT ROBOTIC ADRENALECTOMY: A SINGLE INSTITUTIONAL EXPERIENCE

Benjamin Rudnick, Teona Iarajuli

Introduction and Objective: The Single-port (SP) robotic platform has been increasingly utilized in urology for a variety of surgical procedures. The goal of this study is to describe our experience with SP robotic-assisted adrenalectomy and compare perioperative outcomes to the multi-port (MP) approach. To our knowledge this is the largest series of SP robotic adrenalectomy to date.

Methods: This is a retrospective, single-center study of adult patients who underwent robotic-assisted adrenalectomy between March 2019 and April 2022 by a single surgeon using an IRB-approved institutional database. Patient demographics, perioperative data, surgical pathology, and postoperative outcomes were assessed and compared between the SP and MP groups. Continuous data was analyzed using the Wilcoxon Rank Sum test. Categorical data was analyzed using Chi-Squared and Fisher's Exact Tests where appropriate.

Results: 19 patients were identified who underwent robotic-assisted laparoscopic adrenalectomy by a single surgeon. 14 patients underwent SP adrenalectomy and 5 underwent MP adrenalectomy. Of note, two patients who underwent SP adrenalectomy underwent concomitant partial nephrectomy for a small renal mass, and one patient underwent ipsilateral simple nephrectomy for a nonfunctional kidney. Among the SP and MP groups, there were no significant differences in patient demographics aside from BMI which was significantly lower in the MP group (30.9 vs 23.1 kg/m², p=0.023), as seen in Table 1. There were no statistically significant differences in median adrenal mass diameter (4.2 vs 3.5cm, p=0.610), operative time (76.0 vs 86.0 mins, p=0.516), or estimated blood loss (50.0 vs 50.0 mL, p=0.205) between SP and MP cohorts. No positive margins were identified on final pathology among the 14 SP patients, whereas there was one positive margin among the 5 MP patients. The median length of stay was 23.5 and 25.0 hours for SP and MP, respectively (p=0.578). No major Clavien-Dindo complications occurred in any of the 19 patients.

Conclusions: SP robotic adrenalectomy appears to be a safe and effective approach for the surgical management of select adrenal masses. Complication rates are low and equivalent to MP adrenalectomy. Additional studies with increased sample size are needed to further validate our findings.

Table 1: Patient Demographics and Perioperative Data

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Single-port (n=14)</th>
<th>Multi-port (n=5)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yr)</td>
<td>54.0 (41.5-60.8)</td>
<td>62.0 (51.0-75.0)</td>
<td>0.165</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>30.9 (27.9-34.0)</td>
<td>23.1 (22.1-27.2)</td>
<td>0.023</td>
</tr>
<tr>
<td>Race</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>12 (85.7)</td>
<td>5 (100)</td>
<td></td>
</tr>
<tr>
<td>Black/African-American</td>
<td>1 (7.1)</td>
<td>0 (0)</td>
<td></td>
</tr>
<tr>
<td>Hispanic</td>
<td>1 (7.1)</td>
<td>0 (0)</td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>7 (50)</td>
<td>2 (40)</td>
<td>1.000</td>
</tr>
<tr>
<td>Female</td>
<td>7 (50)</td>
<td>3 (60)</td>
<td></td>
</tr>
<tr>
<td>Smoking status</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current</td>
<td>4 (28.6)</td>
<td>0 (0)</td>
<td>0.286</td>
</tr>
<tr>
<td>Former</td>
<td>3 (21.4)</td>
<td>3 (60)</td>
<td></td>
</tr>
<tr>
<td>Never</td>
<td>7 (50)</td>
<td>2 (40)</td>
<td></td>
</tr>
<tr>
<td>Diabetes</td>
<td>1 (7.1)</td>
<td>1 (20.0)</td>
<td>0.468</td>
</tr>
<tr>
<td>Hypertension</td>
<td>12 (85.7)</td>
<td>2 (40.0)</td>
<td>0.084</td>
</tr>
<tr>
<td>Prior abdominal surgeries</td>
<td>9 (64.3)</td>
<td>4 (80)</td>
<td>1.000</td>
</tr>
<tr>
<td>Functional adrenal tumor</td>
<td>4 (28.6)</td>
<td>0 (0)</td>
<td>1.000</td>
</tr>
<tr>
<td>Adrenal mass diameter (cm)</td>
<td>4.2 (1.9-6.5)</td>
<td>3.5 (1.8-5.3)</td>
<td>0.610</td>
</tr>
<tr>
<td>EBL (mL)</td>
<td>50.0 (20.0-150.0)</td>
<td>50.0 (12.5-450.0)</td>
<td>0.205</td>
</tr>
<tr>
<td>Operative time (min)</td>
<td>76.0 (70.5-95.3)</td>
<td>86.0 (73.0-97.0)</td>
<td>0.516</td>
</tr>
<tr>
<td>Length of stay (hrs)</td>
<td>23.5 (18.2-30)</td>
<td>25.0 (19.5-61.0)</td>
<td>0.578</td>
</tr>
<tr>
<td>Positive surgical margin</td>
<td>0 (0)</td>
<td>1 (20)</td>
<td>1.000</td>
</tr>
<tr>
<td>Perioperative complications (Clavien-Dindo ≥3)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>1.000</td>
</tr>
</tbody>
</table>

Note: values in parentheses correlate to IQR for continuous data, and percentages for categorical data.
A METHOD FOR NAVIGATION DURING ENDOSCOPIC KIDNEY SURGERY
Ayberk Acar¹, Daiwei Lu¹, Yifan Wu¹, Ipek Oguz¹, Nicholas Kavoussi², Jie Ying Wu¹
¹ Dept. of Computer Science, Vanderbilt University ² Dept. of Urology, Vanderbilt University Medical Center

Introduction: Navigation during endoscopic kidney surgery can provide endoscope tip position information with respect to patient anatomy and target pathology. Currently, navigation during endoscopic kidney surgery is performed via intraoperative mental mapping by the surgeon. However, current endoscopes have a limited field and depth of view which limit accurate endoscope localization within the collecting system [1,2]. Furthermore, during surgery, bleeding and debris can impair visualization complicating endoscopic navigation by the surgeon. The inability to completely navigate the intrarenal collecting system leads to missed kidney stones or tumors and contributes to recurrence. We propose a method of navigation to localize the endoscope tip position within a map of the collecting system during endoscopic kidney surgery.

Methods: We collected five endoscopic surgical videos during upper tract tumor ablation. Respective preoperative CT images were obtained as well, and the collecting system was manually segmented. We compared 3D reconstruction performances of three standard structure from motion (SfM) algorithms: (1) COLMAP (with scale-invariant feature transform) pipeline [3], (2) SuperPoint and SuperGlue (i.e. Pixel-Perfect without refinement, a neural network based method) pipeline, and (3) Pixel-Perfect (with refinement) [4]. We performed 3D registration to align the reconstructed models to the segmented CT scan [6]. We further leveraged endoscope pose estimation features of the SfM algorithms to track endoscope tip position (Figure). We evaluated reconstruction performance based on the number of features extracted and number of successful reconstructed. We also calculated root mean square error (RMSE) for registration accuracy.

Results: All three algorithms were able to generate 3D reconstructions from the endoscopic videos. We found SuperPoint and SuperGlue models to have the highest reconstruction percentage range over three endoscopic videos (maximum value: 96%, mean:57%), compared to Pixel-Perfect (96%, 39%) and COLMAP (33%, 25%). Inlier RMSE for registration accuracy of endoscopic reconstructions was 0.45mm with 17.29% inlier-to-total points ratios. On the resulting registration, coverage of endoscope videos, endoscope tip positions for each endoscope frame used in the reconstruction, and the general path of the endoscope can be easily observed.

Conclusion: We depict a method for navigation during endoscopic kidney surgery. By combining endoscopic surgical video and preoperative CT imaging, we can create a patient-specific map which can localize endoscope tip position intraoperatively.
ABSTRACT # 22

BEST ABSTRACT AWARD

MAGNETIC RETRIEVAL OF STONE FRAGMENTS: DESIGN, PROTOTYPING AND HEAD-TO-HEAD COMPARISON WITH STONE RETRIEVAL BASKET

Daniel Massana Roquero¹,², T. Jessie Ge¹,² Zachary Kornberg¹,², Grace H. Holton¹,², Kathleen E. Mach¹,² Shan X. Wang³, Joseph C. Liao¹,²

¹ Department of Urology, Stanford University, Stanford, USA; ²VA Palo Alto Health Care System, Palo Alto, USA; ³Department of Materials Science and Engineering, Stanford University

Introduction: Residual stone fragments are found following approximately 30% of ureteroscopic laser lithotripsy and are associated with complications and recurrence. To address the inefficiency of standard approaches for fragment removal, we are developing Magnetic System for Total Nephrolith Extraction (MagSToNE)¹, which is based on coating stone fragments with a magnetic hydrogel followed by magnetic capture and bulk removal. Herein we report optimization of a MagSToNE injector and retriever prototype. Using an in vitro kidney model and patient-derived stone fragments, the prototype was evaluated in a competitive analysis with conventional stone basket.

Methods: The MagSToNE injector consist of a 3F infusion catheter that contains a dual lumen made of polyimide tubing (0.25 mm inner diameter). To develop the MagSToNE retriever, different magnetic arrangements (cylinder or ring magnets axially or diametrically magnetized) were simulated with COMSOL Multiphysics 5.5. The magnets (10 units, 1 mm length, 0.75 mm outer diameter) were stacked together and coupled into the distal tip of a guidewire. For the head-to-head comparison, patient-derived stone fragments were loaded into a 3D-printed kidney model (vendor). First, the stone fragments were removed using a nitinol retrieval basket (vendor) and then with MagSToNE. Time and number of retrievals needed for stone-free status were recorded.

Results: The MagSToNE injector allowed the infusion of both MagSToNE gel components into the stone fragments under direct visualization from the scope. For the magnetic wire, magnetization along the magnet axis only permitted stone capture at the distal tip of the magnetic wire (Figure 1A). On the other hand, diametrically magnetized magnets were able to capture multiple stone fragments along the length of the magnet. Both MagSToNE injector and retriever were compatible with disposable ureteroscopes and did not affect their deflection capability (Figure 1B). MagSToNE showed to be up to 54% faster than basketing in fragments 1-2 mm in size and more efficient. In addition, it demonstrated excellent performance removing fragments (0-1 mm) that cannot be extracted with baskets. Experiments with larger fragments and different compositions are still in progress.

Conclusion: MagSToNE can be delivered and deployed in kidney models using conventional ureteroscopic equipment. Furthermore, MagSToNE showed superior efficiency in the retrieval of small stone fragments compared to basket retrievers. We hope that these findings, along with future in vivo safety studies, will path the way towards clinical translation of MagSToNE.

Figure 1. A) Simulated magnetic gradient (blue) and actual image of magnetic stone capture by axially (left) and diametrically (right) magnetized cylinder magnets. B) Endoscopic view of the MagSToNE injector dual lumen (left) and the MagSToNE retriever with multiple patient-derived fragments captured.
ACHIEVING A BLADDER ACELLULAR MATRIX WITH PRESERVED ARCHITECTURE AND MECHANICS OF THE HEALTHY NATIVE BLADDER

Victoria Lee¹, Felix Yiu¹, George Aninwene II¹, Astha Sahoo¹, Jonathan Shiba¹, Nohemi Garcia-Soto¹, Vijaya Pandey², James Wohlschlegel², Renea Sturm¹
¹ UCLA Department of Urology; ² UCLA Proteome Research Center

Introduction: Acellular matrices are a key source of biologic scaffolds applied in tissue engineering with varied results. One challenge in this field is the use of varied decellularization protocols. As scaffolds increasingly are developed in a hybrid or synthetic manner, it is vital to better understand the nanotopography, mechanics, and protein content present in the native healthy extracellular matrix (ECM). The aim of this study was to compare common decellularization protocols, with a goal of achieving effective cellular protein (≥85%) and DNA removal (≥90%) while preserving ECM protein and maintaining ultimate tensile strength (UTS) and tissue structure.

Methods: Porcine bladders were decellularized with 0.5% Sodium Dodecyl Sulfate (SDS) [1] or 0.25% Trypsin-hypotonic-Triton X-100 hypertonic (TT) [2] protocols. Decellularization efficacy (DAPI, DNA quantification) and ECM structural maintenance (histology, scanning electron microscopy (SEM) and total protein) were assessed. Mechanical characterization was completed using an Instron 345C-1 mechanical tester (0.5 N, 10 mm/min). SDS and TT data were compared using two-tailed unpaired t-tests. Native, TT, and SDS cohorts were compared using one-way ANOVA; Tukey’s post-hoc tests for among group differences. Data presented as mean ± standard error.

Results: Effective nuclei removal was achieved by SDS and TT (Figure 1A, D). SDS more effectively maintained qualitative tissue architecture (B, C). Target DNA removal was achieved with SDS but not TT (E). The tensile modulus increased, and elasticity decreased after decellularization; UTS was unaffected (F). BCA protein assay showed decreased total protein content by 83.8% ± 4.1 post-SDS and 65.2% ± 8.4 post-TT.

Conclusion: The results indicated that SDS was superior to TT in achieving targeted decellularization efficacy and DNA removal, while maintaining key structural, mechanical and biological properties of native tissue. Post-SDS protein extraction aligned with published content of bladder cellular and ECM protein [3]; a complete proteomic evaluation is ongoing. This study provides key comparative information to facilitate ECM evaluation in healthy versus diseased tissues and to inform the creation of bio-inspired scaffolds for tissue engineering.

Figure 1. A. DAPI Staining. B. H&E and C. SEM evaluation of Native, TT and SDS. D. Nuclei quantification. E. Percent DNA removed. F. Mechanical properties.

Funded by AUA / Urology Care Foundation and KL2 Intramural Funding.
ABSTRACTS

ABSTRACT # 24

VARIATION IN AUS PRESSURE REGULATING BALLOONS AND CUFF FOLLOWING EXPLANATION

Shree Agrawal-Patel MD1, Kevin Lewis MD1, Mohamed Elazab BS2, Madison Lyon MD1, Tara Nagle MS2, Jeremy Loss MS2, Bradley Gill MD1, Kenneth Angermeier MD1, Steve Majerus PhD4, Margot Damaser PhD1,2,3

1 Cleveland Clinic, Glickman Urological and Kidney Institute, Department of Urology; 2 Cleveland Clinic, Lerner Research Institute, Department of Biomedical Engineering; 3 Louis Stokes Cleveland Veterans Affairs Medical Center, Advanced Platform Technology Center
4 Case Western Reserve University, Department of Electrical, Computer and Systems Engineering

Introduction: Artificial urinary sphincters (AUS) are the gold standard for male stress urinary incontinence (SUI). Explant for recurrent SUI occurs in 2-29% of patients and is presumed to be from urethral atrophy. [PMID: 11458065, PMID: 26135815] However, decreased pressure transmitted from the pressure regulating balloon (PRB) may contribute [PMID: 26384584]. Our aim is to determine the mechanical and pressure properties of PRBs and cuffs as a function of implant duration.

Methods: Mechanical testing was done on 10 explanted cuffs and pressure and mechanical testing was performed on 11 explanted PRBs and one unused PRB from 10/2021 to 2/2023. PRBs were filled from 20 mL to 25 mL of saline, measuring pressure at every 1 mL increment. Tensile stress/relaxation and cyclic testing were performed from 50% to 350% strain. Linear regression models were used to assess the effect of duration of implantation on mechanical and pressure parameters.

Results: A majority of patients underwent AUS for post-prostatectomy SUI (90%), and explant was done for recurrent SUI (75%), device infection (10%), and/or urethral erosion (25%). The average age at time of explant was 75 years old and implant duration ranged from 2-131 months. Two PRBs appeared to have a leak as increasing volume resulted in decreased pressure and were excluded from data analysis. Pressure in the 9 PRBs measured at 25 mL volume was 64.9 ± 6.5 (standard deviation) cm H2O with the unused device measuring 65.7 cm H2O (Figure 1). From linear regression of the data, the effect of duration of implant on PRB pressure was -0.19 (cm H2O/month), R² = 0.76, p = 0.001. Young’s modulus, derived from cyclic mechanical testing, was 133 deca Pascals (DPa)/month for PRBs, R² = 0.41, p = 0.047 and 79.5 DPa/month for cuffs, R² = 0.06. The effect of duration of implant on maximum stress at 50% strain was 291 DPa/month for PRBs, R² = 0.53, p = 0.02 and 223.4 DPa/month for cuffs, R² = 0.45, p = 0.03. The effect of duration of implant on relaxation stress at 50% strain was 119 DPa/month for PRBs, R² = 0.44, p = 0.10 and 247.2 DPa/month for cuffs, R² = 0.55, p = 0.01. The effect of duration of implant on maximum stress at 350% strain was 1441 DPa/month for PRBs, R² = 0.66, p = 0.004 and 1761 DPa/month for cuffs, R² = 0.45, p = 0.006. The effect of duration of implant on relaxation stress at 350% strain was 1163 DPa/month for PRBs, R² = 0.71, p = 0.002 and 1348 DPa/month for cuffs, R² = 0.66, p = 0.004.

Conclusion: In conclusion, in this pilot study there is a correlation with increased mechanical stress and Youngs modulus in both AUS PRBs and cuffs as well as decreased pressure in PRBs with increased duration of implant, indicating a potential change in material properties. These changes in mechanical properties with increasing implant duration may contribute to changes in device function.

Figure 1: Time to AUS Explant with Change in PRB Average Pressure Measured from Volumes of 20 to 25 mL
THULIUM FIBER LASER: IMPACT OF PULSE WIDTH MODULATIONS ON TEMPERATURE GENERATION

Eric Riedinger1, Joel M. H. Teichman2, Tasha Posid1, Bodo Knudsen1
1The Ohio State University Wexner Medical Center, Department of Urology, Columbus OH
2University of British Columbia, Department of Urologic Sciences, Vancouver BC

Introduction: Lengthening of the pulse duration during laser lithotripsy is utilized to reduce stone retropulsion [1]. Commercial thulium fiber lasers (TFL) allow for adjustment at pre-set pulse durations. As pulse duration lengthens, a loss of thermal confinement with resultant dispersion of energy outside of the intended target can occur [2]. We aim to evaluate the impact of lengthening pulse width on temperature generation in an in vitro experiment.

Methods: Utilizing the SOLTIVE Premium-SuperPulsed Thulium Fiber Laser System (Olympus Medical Systems), a 150-micron fiber was fired continuously for 300 seconds into 30 milliliters of normal saline. Laser parameters were set to 1.5 J and 20 Hz. The pre-set short and long pulse durations were compared. Temperature measurements were obtained every two seconds using a thermocouple data logger (PerfectPrime TC0378) and metal probe thermocouple sensor (PerfectPrime TL1813 Sensor). The thermocouple sensor was located two centimeters lateral to laser fiber. Three separate trials were conducted under the short and long pulse duration settings.

Results: An aggregate score was calculated by taking the average temperature per second across short- and long-pulse durations conducted across three timepoints. Lengthening of pulse duration resulted in higher temperatures (p=0.002). See Figure 1. A mean of the first 15 (Mean_Short=19.45 vs. Mean_Long=19.18 seconds, p=0.341) and last 15 seconds also indicate this trend (Mean_Short=68.14 vs. Mean_Long=76.18, p<0.001). The maximum temperature achieved for the long pulse duration arm was 79.6 Celsius compared to 71.8 Celsius in the short duration arm.

Conclusion: Lengthening of pulse duration while utilizing TFL results in higher temperatures when frequency and power levels are controlled. This may be attributed to a loss of thermal confinement, via increased laser firing time, with dispersion of emitted energy towards the thermocouple probe.

![Thulium Fiber Laser: 150 micron, 20 Hz, 1.5 J](image)

Figure 1. Temperature versus elapsed time.
ABSTRACT # 26

GRAVITY-INDEPENDENT CATHETER DESIGN TO REDUCE INTRAVESICAL PRESSURE

Susanna Ferrier¹, John Morgan¹, Giorgio Conta¹, Samika Karthik¹, Anika Kulkarni¹, Sarah O’Donovan¹, Jacob Saucedo¹, Justin Chen¹, Salil Patel¹, Juan Ramirez², Liang Gao¹, George Aninwene II¹, Maurice Garcia³, Renea Sturm²

¹ Department of Bioengineering and ² Department of Urology, University of California, Los Angeles ³ Department of Urology, Cedars Sinai Medical Center

Introduction: Catheter associated urinary tract infections (CAUTIs) account for 30% of health-care associated infections, with an estimated annual U.S. hospital expenditure of $450 million [1]. Dependent loop formation within catheter tubing contributes to increased intravesical pressure (Pves), thereby increasing patient discomfort and CAUTI risk [2,3]. The aim of this study was to evaluate the effect of a gravity independent Archimedes screw prototype (U.S. Patent #11376151) on Pves during benchtop testing, using dependent loop heights derived from hospital observations. Methods: A two-part study was completed. 1) Hospital-based measurements: A clinical observer measured dependent loop heights of indwelling catheters in supine patients across five surgical and non-surgical units at a university hospital. The difference between the minimum and maximum heights of the dependent loop were measured via tape measure and determined the height of the dependent loop (Figure 1A). Median, 25th, and 75th percentile data points were calculated. 2) Benchtop prototype testing: An ex vivo porcine bladder was catheterized with a 16F catheter per urethra, with an elastic band tied around the urethra and ureters to prevent leakage. A KAMOER peristaltic pump infused distilled water into the bladder at 50 mL/min at room temperature. Pressure (mmHg) within the bladder was measured by a Pasco wireless pressure sensor inserted into the bladder dome and secured in a watertight fashion. Cohorts were defined as having 3 dependent loop heights (median, 25th and 75th quartile dependent loop heights from the clinical observation study), with Pves evaluated continuously during infusion at each height either with or without an Archimedes screw. The primary outcome measure was the plateau Pves required to restore drainage after flow cessation due to the dependent loop. The screw was inserted into the catheter tubing spanning 10 to 20.9 cm above the minimum point of the dependent loop (Figure 1B), with a continuous rotation rate of 9000 rpm. Results between standard and Archimedes screw cohorts at each height were compared using an unpaired T-test, with significance defined as p<0.05. Results: During clinical observation, median, 25th, and 75th percentile dependent loop heights from 30 patients were 22.86 cm, 17.86 cm, and 26.3 cm respectively; 8 patients were excluded from analysis as a catheter was present but no dependent loop was observed. The mean plateau Pves ± standard error (SEM) with a dependent loop height of 17.86 cm without the screw was 5.3±.31 mmHg. This decreased significantly to 3.5±.72 mmHg (p<0.01) when the prototype was applied. The 25th and 75th percentile cohorts mean PVes likewise decreased significantly with prototype application (Figures 1C, 1D, p<0.01). Conclusion: The Archimedes screw prototype is a novel method that effectively decreased Pves by overcoming dependent catheter loops in benchtop testing. The described prototype is a promising method to decrease the effects of dependent loops on patient discomfort and CAUTI risk.


Figure 1. (A) Dependent loop depiction (B) Archimedes screw design, including cross section (C) Representative PVes vs Volume infused curves for each evaluated height with and without screw (D) Mean PVes ± SEM to overcome dependent loop for each height with and without screw (n=6/cohort, all pairwise comparisons p<0.01 with vs without device)
A PROVIDER-PATIENT INTERACTIVE APP TO AUDIO-RECORD AND SHARE PATIENT CONSULTATIONS AND DECISION-MAKING DISCUSSION

Stelmar, J. 1, 2, Smith, S. 1, 2, Lee, G. 1, 2, Sandhu, S. 1, 2, Mallavarapu, S. 1, 2, and Garcia, MM. 1, 2

1 Department of Urology, Cedars-Sinai Medical Center, Los Angeles 2 Cedars-Sinai Transgender Surgery and Health Program

Introduction: It is well documented that patient memory for medical information is often poor and inaccurate. While the use of audio recordings during patient consultation has been described, no practical and user-friendly model has been developed. Our aims were: 1. To determine whether, and if so, how, providing patients presenting for genital gender-affirming surgery with an audio recording of their consultation could benefit patients; 2. Develop a simple-to-use smartphone-based recording device that is also interactive with patients. Genital gender-affirming surgery (gGAS) is complex, the discussion is long, and includes variable surgery options, each with unique risks and benefits for patients to consider.

Methods: We offered all new patients presenting for gGAS with the option to have their consultations recorded. We informed them that at the end of the consultation the recording would be uploaded to a USB and given to the patient to keep, and, that we would keep a copy for our records. We then surveyed all patients who had received an audio copy (anonymous, internet-based) to query whether they found this useful, and when/with whom they listened to the audio file.

We then developed a smartphone app to simplify the technological aspect of our approach. We drew from patient feedback to understand what the most common questions patients have after such consultations and created a means for the provider to attach this Q&A to share with patients.

Results: 71/72 (98.6%) patients who were given the option to have their consultation recorded chose to do so. 50/71 (70%) of patients who had their consultation recorded responded to our survey (Figure 1a). Patients reported that having access to a voice recording of their consultation was beneficial and was viewed overwhelmingly positively (Figure 1b.).

We created a smartphone App [Figure 1c] (Visit Replay, iOS and Android; U.S. and International Patents Pending) that: 1. Records up to 90 minutes of consultation audio; 2. Allows the User to attach any number of desired files (manuscripts, Word docs, pictures, and video; 3. Allows a hyperlink to be pasted in the email (e.g. a provider’s clinical study, or, their website containing pictures or publications), and 4. Emails the audio and attachments to the patient and the provider (for provider medico-legal protection), followed by immediate deletion of patient information and audio recording from the App.

Conclusion: Routine audio recording of patient consultations is highly beneficial to patients, with little cost to providers. Per our institution’s Office of Risk Management, audio recordings are protective against medico-legal risks, for the provider/institution. This approach may have applications in broader clinical contexts where patients face numerous, complex, and nuanced discussions and complex management options. Since patients face the same challenges during medical consultations throughout the world, a larger (multi-center, international, multi-language) study is warranted.
ABSTRACTS

ABSTRACT # 28

GENDER-BASED DIFFERENCES IN SURGEON ERGONOMICS DURING SIMULATED URETEROSCOPY USING EMG

Erin Kim¹, Alec Sun¹, Juan Sebastian Rodriguez-Alvarez², Louisa Ho², Kyle O’Laughlin³, Smita De²
¹ Case Western Reserve University School of Medicine, ² Cleveland Clinic Glickman and Urological Kidney Institute, ³ Cleveland Clinic Lerner Research Institute
Department of Biomedical Engineering

Introduction: There is a high prevalence of musculoskeletal complaints among urologists, particularly female urologists [1, Figure 6.2]. In addition, higher ureteroscopy (URS) case load has been associated with increased orthopedic problems. Ergonomics during URS has not been well studied, particularly as related to gender. We aimed to assess differences in muscle activation and mental workload during simulated URS based on gender. We also assessed surgeon position and different ureteroscope types.

Methods: Urology trainees and staff at our institution were recruited. Subject variables (including gender and glove size) were collected. Surface electromyography (EMG) was measured in muscle groups of the upper limb and back. The maximum voluntary contraction (MVC) was measured for each muscle 3 times, followed by EMG measurements during 3 simulated flexible URS tasks in randomized order: navigation, basketing, and dusting. Subjects were evaluated while sitting vs. standing and with single-use vs. reusable ureteroscopes. The root-mean-square of the EMG signal was calculated for each muscle in each condition and then normalized to the mean MVC for each subject to produce %MVC. Mean %MVC in each muscle was compared between men and women for different conditions. Mental workload was assessed using the National Aeronautics and Space Administration Task Load Index (NASA-TLX). Paired Wilcoxon rank-sum tests and multivariate linear regressions were conducted to associate %MVC of muscle groups with trial conditions and gender.

Results: Women had greater %MVC than men in the forearm flexor, forearm extensor, biceps, and triceps in all conditions, with the greatest difference displayed in the forearm flexor across positions and ureteroscope types (Figure 1). Even when evaluating by task, deltoid and trapezius did not differ between men and women. While using the reusable ureteroscope, an increase of 1 in glove size decreased forearm flexor MVC by 6.69%. Women reported higher mental workload per NASA-TLX scores for all comparisons (p<0.01).

Conclusion: Surgeon ergonomics, as assessed by muscle activation and mental workload, during URS may vary between men and women and should be further investigated. Ureteroscope design could potentially be optimized for smaller hand sizes to reduce muscle strain and risk of injury.

Funding: Cleveland Clinic Research Program Committee and Glickman Urological Kidney Institute

Figure 1. % MVC by surgeon gender, position, and ureteroscope type. * p≤0.05, ** p≤0.01, *** p≤0.001
ABSTRACT # 29

PENILE TUMESCEENCE CHARACTERIZATION USING A NOVEL PENILE “SMART RING”

Riley Daily¹, Elliot Justin¹, Jim Hotaling², Amy Pearlman³, Philip Cheng⁴, Ashley Winter⁵
¹ Firmtech; ² University of Utah; ³ Private Practice; ⁴ RMA; ⁵ Odela Health

Introduction: Firmtech is a novel penile “smart ring” that allows data collection regarding strength, duration, and frequency of erections over a period of time. The device currently has two sensors—a pressure sensor and a strain gauge. These sensors are used together to create a time series of data of the penile activity while wearing the device.

Methods: 1400 recordings of nocturnal erectile activity from the Firmtech ring were analyzed. The time limit was set to 250 minutes.

Results: The mean and standard deviation for the number of erections and the total duration of erections are included below.

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Erections</td>
<td>1.688</td>
<td>1.849</td>
</tr>
<tr>
<td>Total Duration Erect</td>
<td>2922.41 (Seconds)</td>
<td>4011.22 (Seconds)</td>
</tr>
</tbody>
</table>

Here is an example graph produced for a user. This graph shows an example of an overnight recording with likely an episode of sexual activity followed by 3-4 nocturnal erections.

Conclusion: This novel device was able to safely record penile tumescence in a home setting.
THREE-DIMENSIONAL MODELING APPLICATIONS FOR SURGICAL SPATULATION FOR UROLOGIC RECONSTRUCTION

Samhita Mallavarapu¹, Sandeep S Sandhu¹,², Shannon M Smith¹,², Maurice M Garcia¹,²
¹Department of Urology, Cedars-Sinai Medical Center, Los Angeles, CA
²Cedars-Sinai Transgender Surgery and Health Program, Cedars-Sinai Medical Center, Los Angeles, CA

Introduction: Surgical injury to tubular structures such as the ureter can have significant ramifications on the urogenital system if repaired incorrectly, as this can result in issues such as structuring at the area of repair. As a result, techniques have evolved utilizing spatulation to minimize shortening of the tube and also allow for a water-tight repair. The question that has arisen then becomes whether there is a specific angle at which spatulation can occur which will optimize the repair and prevent shortening of the structure. Our aim was to determine the changes in circumference of a 3-D modelled tubular structure to determine if there was an optimal angle at which spatulation should occur to maximize the repair, and limit shortening of the structure.

Methods: Four, 3-dimensional CAD files were made of a hollow tubular structure with an external circumference of 12 cm, and an internal circumference of 11.0584 cm. These 4 models were then cut at specific angles, 30°, 45°, 60°, and 75° to measure the outer circumference of the models in addition to the length from the plane of dissection to the tip of the new length.

Results: Measurements were focused on the outer circumference of the model and the added length of the specific model. Results are shown in Table 1 below. Overall, the more extreme the angle of spatulation from 30 to 70 degrees, the greater the outer circumference and length from the plane of dissection, aiding in the preservation of the structure and limiting the risk of structuring.

Conclusion: Spatulation preserves significantly more circumference and length than simply cutting perpendicular to the tube-like structure that is being dissected. Through the optimization of this technique, surgeons can preserve length of tubular structures such as the ureter when injuries, or other reasons for transection occur.

Table 1.

<table>
<thead>
<tr>
<th></th>
<th>0°</th>
<th>30°</th>
<th>45°</th>
<th>60°</th>
<th>75°</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outer Circumference (C)</td>
<td>120 mm</td>
<td>129.458 mm</td>
<td>145.932 mm</td>
<td>185.049 mm</td>
<td>317.741 mm</td>
</tr>
<tr>
<td>Added Length (L)</td>
<td>--</td>
<td>22.055 mm</td>
<td>38.200 mm</td>
<td>66.164 mm</td>
<td>142.564 mm</td>
</tr>
<tr>
<td>Ratio of C to L</td>
<td>--</td>
<td>5.870</td>
<td>3.820</td>
<td>2.797</td>
<td>2.229</td>
</tr>
</tbody>
</table>
ABBREVIATION #31

ROBOTIC RADICAL PROSTATECTOMY USING NOVEL APPROACHES IN PATIENTS WITH A HOSTILE SURGICAL ABDOMEN

Albert Geskin, Ethan Ferguson, Roxana Ramos, Jay Chavali, Jihad Kaouk
Cleveland Clinic

Introduction: Prostate cancer treatment is challenging in surgically complex patients. Proximity of small bowel to the prostate often makes radiation a poor option, and intraperitoneal adhesions may prohibit standard minimally invasive surgical management. In order to avoid peritoneal entry, radical prostatectomy (RP) has been performed with the novel single port (SP) robot utilizing transperineal (TP) and transvesical (TV) approaches. We sought to study and compare the outcomes of radical prostatectomy using these approaches in patients with extensive prior abdominal surgeries.

Methods: From 2014 to 2022, 50 patients with extensive prior abdominal surgeries who underwent TP (24) and TV (26) robotic RP were identified. Prior surgical history included laparotomies with J pouch reconstruction (19, 38%), ileostomy or colostomy creation (17, 34%), and open bowel resection (9, 18%). 12/50 (24%) had a history of abdominal incisional hernia repair with mesh. Data parameters were maintained in an IRB-approved database and a retrospective analysis was performed. Chi-square test was used to compare categorical variables and t-test was used to compare quantitative variables.

Results: All cases were completed without open conversion, intraoperative complications, or blood transfusions. Length of hospital stay was 7.8 hours after TV RP and 23.1 hours after TP RP (p=0.04). Opioids were prescribed in 8% of TV RP cases versus 40% of TP (p<0.01). Postoperative complications were noted in 15/50 total cases (30%), including 11/24 (46%) TP versus 4/26 (15%) TV cases (p=0.07). High grade complications (Clavien 3 or above) were seen in 4/50 cases, all in the TP cohort (p=0.05). Pathologic staging revealed extra-capsular extension in 17/50 cases (5 TV vs 12 TP) and seminal vesicle invasion in 9/50 cases (7 TV and 2 TP), the remainder (24/50) were organ confined. Positive margins were noted for 23/50 patients (46%). To date, biochemical recurrences have been noted in 4 patients (8%, 2 TV and 2 TP, p=1.0). Immediate continence was noted for 38% of TV patients. Long-term continence after 6 months was 94% in TV and 68% in TP (p=0.04).

Conclusion: The SP robot has enabled the development of new approaches for minimally invasive RP. Both TP and and TV approaches are feasible for patients with hostile abdomens. The TV approach is preferred as it offers advantages of shorter hospital stay, less opioid use, fewer high-grade complications, and improved continence.
ABSTRACT # 32

AN EXTENSION TO A LUMPED-PARAMETER MODEL FOR KIDNEY PRESSURE DURING STONE REMOVAL

Jessica Williams, Alycia Abbott, Candace Rhodes, Cassie Hailson, Aditi Ray
Boston Scientific, Inc

Introduction: Previous work has derived mathematical models to predict relationships between irrigation flowrates and pressures during ureteroscopy (URS) [1, 2, 3]. These models can be harnessed to quantify the impact of clinically relevant variables (e.g., tool size, access sheath use, irrigation pressure) on intrarenal pressure (IRP). This foundational work assumes sufficiently low flowrates through the ureteroscope such that flow is laminar, and the relationship between the pressure drop along the length of the scope and the flowrate through it is linear. Here, we reconsider this assumption, and determine ureteroscopy conditions under which flows through the scope are no longer laminar, and relationships between flows and pressures are nonlinear. With this incorporated into our mathematical modeling framework, we can more accurately predict flowrates and IRPs across the full operating space, and we validate the mathematical model with data from bench-top experiments.

Methods: The presented mathematical model builds upon a previously published lumped-parameter model that connects flow through the scope working channel and back through the access sheath via the kidney, which is modeled through a constitutive, exponential compliance law [2]. Resistances to flow through the scope (inflow resistance) and out through the access sheath or ureter (outflow resistance) are estimated within a plausible range using physics-based relationships that depend on the relevant cross-sectional geometry [4], and confirmed via comparison to bench-top experiments. The novel extension to the model is through the use of the empirical, nonlinear Blasius correlation to relate the pressure drop across the scope to the flowrate through it at sufficiently high flowrates where the Reynolds number is above the laminar threshold (see Figure 1). The resulting system is a set of differential-algebraic equations which are solved in MATLAB® [5].

Results: The incorporation of a nonlinear pressure/flow relationship through the scope at high flowrates improves the accuracy of the mathematical model, as tested through comparison with bench-top data. The model accurately predicts both steady-state and time-dependent flowrates and IRPs, and how these vary with working tool size, access sheath size, kidney compliance, and irrigation pressure.

Conclusion: Mathematical modeling of ureteroscopy irrigation has enormous potential to guide ureteroscopic device design, and to aid in understanding the impact of different operating setups on flowrates and IRPs. The work here is part of a continued effort to improve the fidelity of this modeling framework while maintaining computational simplicity to ensure efficient and accurate in-silico predictions.

Acknowledgement & Disclaimers: The authors would like to thank BSC employee Troy Velazquez for his support to the development of this work. Disclaimers: Testing was performed by Boston Scientific. Bench test results may not necessarily be indicative of clinical performance. Data on file.

Figure 1. Reynolds number as a function of flowrate through the working channel (blue), 11/13 UAS access sheath (red), and patient line tubing (yellow).
**ABSTRACTS**

**ABSTRACT #33**

**RADIOFREQUENCY ABLATION OF RENAL TUMORS 3-7 CM WITH DIRECT REAL TIME TEMPERATURE MONITORING USING NON-CONDUCTING FIBEROPTIC THERMISTORS: TECHNIQUE AND 14-YEAR FOLLOW UP OF ONCOLOGIC AND RENAL FUNCTION OUTCOMES**

Benjamin Behers, 1 Spencer Kortum, 1 Genesis Dolgetta, 2 Tonya S. King, 2 and Robert I. Carey 1

1 Florida State University College of Medicine; 2 Sarasota Memorial Hospital Research Institute

**Introduction:** In this study we describe the 14-year follow up of oncologic and renal function outcomes for a cohort of patients who underwent laparoscopic radiofrequency ablation (LRFA) of SERMs with real time temperature monitoring of the ablation zone with non-conducting fiberoptic thermistors.

**Methods:** All patients undergoing LRFA for SERM were prospectively entered into an IRB approved database. Renal function was assessed at 3 months and annually thereafter. Changes in GFR were calculated using the Modification of Diet in Renal Disease formula. LRFA was performed with a Covidien Cooltip probe system using multiple probes and multi-pass technique. Direct real-time, fiberoptic temperature monitoring was performed for each case with temperature goals of greater than 60 degrees C achieved at the deep and peripheral margins.

**Results:** The mean patient age was 73.3 years (SD 9.52), mean tumor size of 3.5 cm (SD 1.14), median tumor volume of 17.2 cm³ (1.77, 203.69), and mean RENAL nephrometry score 6.8 (SD 1.36). Median creatinine was 1.0 (0.6, 3.4) pre-surgery, 1.1 (0.7, 3.8) at 3 months, and 1.2 (0.8, 2.4) at 3 years. Mean estimated GFR was 60.2 (SD 19.8) pre-surgery, 55.7 (SD 20.20) at 3 months, and 51.0 (SD 15.84) at 3 years. Thirty-one patients were female (41.3%), laterality was left 39 (52.0%) and right 36 (48.0%), all tumors were solid and enhancing. Pathology showed clear cell 36 (48.0%), papillary 11 (14.7%), chromophobe 1 (1.3%), oncocytic 19 (25.3%), malignant fibrous histiocytoma 1 (1.3%), angiomyolipoma 3 (4.0%), lung cancer metastasis 1 (1.3%), angiomylipoma 3 (4.0%), and nondiagnostic 2 (2.7%).

Over the 14-year follow-up, 3 patients required a partial nephrectomy for locally recurrent RCC and 4 patients required a radical nephrectomy for locally recurrent RCC. Only one of the local recurrences developed metastasis. Overall, there were 4 instances of metastasis after LRFA leading to DSM, two of which were in T1a tumors which resulted in death 5 and 7 years after the ablation, one of which was a T1b tumor with DSM 3 years after RFA, and one of which was in solitary kidney with T1b tumor and history of contralateral nephrectomy for RCC. There were two instances of metastasis without DSM, a T1b patient alive with metastasis 15 years after RFA and a T1b tumor that died of metastatic lung cancer ten years after RFA but also had documented low volume metastatic RCC.

The 14-year overall survival rate was 0.53, and the disease-specific survival rate was 0.94. The risk of overall mortality in this study was 0.26 times lower for ASA 2 vs. 3/4 (95% CI 0.12-0.58), p=0.001, 2.1 times greater for every 1 unit increase in log transformed tumor volume (95% CI 1.18-3.58), p=0.011, 0.64 times lower for every 20 unit increase (1 SD) in calculated pre GFR (95% CI 0.45-0.92), p=0.015, with adjustment for nephrometry score. Nephrometry score was the most significant predictor of salvage therapy (OR 4.0 for every 1-unit increase, 95% CI (1.74-9.0), p=0.001), and metastasis (OR 2.4 for every 1-unit increase, 95% CI (1.25-4.55), p=0.009).

**Conclusion:** This study documents the natural history of LRFA patients with 3-7 cm SERMs followed for 14 years. Although LRFA is feasible with overall excellent preservation of kidney function and 94% DSS, preservation of renal function and RFS decline inversely with tumor size and RENAL nephrometry score. Local tumor bed recurrence, metastasis, and DSM occur over long term follow up with these large tumors despite the independent temperature monitoring. Long term follow-up identified four deaths from metastatic RCC, one of which had pre-existing metastasis but two of which were in T1a patients.
ABSTRACTS

ABSTRACT # 34

USE OF STENCILS FOR DESIGNING THE NEOPHALLUS GLANS RIDGE FOR TRANSGENDER MEN UNDERGOING PHALLOPLASTY

Sandeep S Sandhu¹,², Samhita Mallavarapu¹,², Shannon M Smith¹,², Maurice M Garcia¹,²
¹Department of Urology, Cedars-Sinai Medical Center, Los Angeles, CA
²Cedars-Sinai Transgender Surgery and Health Program, Cedars-Sinai Medical Center, Los Angeles, CA

Introduction: Phalloplasty is a burgeoning area of surgical care for which continues to show innovation. One area of importance is the overall cosmetic appearance of the glans ridge for transgender men who wish to undergo phalloplasty as part of their gender transition. Changes in the shape of the head of the penis can dramatically impact the overall appearance of the penis itself. As a result, our goal was to design several options of glans ridges based on “packers” (soft, silicone plastic penis models of cisgender men’s penises which transgender men place in their trousers to mimic a genital bulge) so that transgender men undergoing phalloplasty could choose a glans ridge which was most appealing to them.

Methods: A survey was designed asking transgender men to pick which glans shape they most preferred from seven packers. The corresponding stencil was then used to temporarily tattoo the individual prior to their surgery who was undergoing surgery for their gender affirmation. Concurrently, a survey is currently being run to determine preferences for glans shape at our institution across all individuals with a preference for partners with a penis.

Results: Transgender men undergoing glansplasty as part of their phalloplasty procedure for surgical gender affirmation were given the opportunity to choose which glans shape appealed most to them and a stencil for that specific glans shape was selected whereupon a temporary tattoo with henna was applied to the glans prior to their surgery. Concurrently, an anonymized questionnaire is currently being undertaken for individuals who either have a penis or are attracted to individuals with a penis to determine if there is a specific preference for glans shape.

Conclusion: In summary, we have designed several stencils which can be applied directly to a neophallus for transgender men undergoing phalloplasty based on their personal preferences to design a penis head shape which is more aesthetically pleasing to the individual undergoing genital gender-affirming surgery.
ABSTRACTS

ABSTRACT # 35

PRESSURE DYNAMICS GENERATED BY URETEROSCOPIC IRRIGATION DEVICES: A COMPARATIVE STUDY OF PATHFINDER BULB, BSC SINGLE-ACTION PUMP, AND NOVAPLUS PRESSURE BAG DEVICES

Ali S. Antar, MD; Margaret A. Knodler, MD; Kristina L. Penniston, Ph.D; Stephen Y. Nakada, MD

1Department of Urology, School of Medicine and Public Health, University of Wisconsin

INTRODUCTION AND OBJECTIVE: The choice of pressure irrigation device has multiple components and is largely left to surgeon or institution preference usually with an eye towards ease of use and simplicity of setup. With increasing clinical interest in effects of pressure generated during ureteroscopy, we sought to evaluate the difference in generated pressure profiles between a bulb pressure pump, a single action pump, and a continuous pressure bag.

METHODS: A clear polyvinylchloride (PVC) tube with an inner diameter of 13mm was closed at one end with a removable plug and an access sheath at the other end to create a closed environment. A comet pressure wire was placed through a flexible ureteroscope inserted in the ureteral access sheath to the enclosed space with only the access sheath as an outlet. We used each device to pump a 500mL saline bag through the simulator and measured the time to deliver the entire bag and the pressures generated.

RESULTS: The single action pump generated a maximum pressure of 52.4mmhg and delivered 500mL saline in 348 seconds, while the bulb irrigation created a maximum pressure of 22.6mmhg and delivered 500mL saline in 336 seconds. The continuous pressure bag did not generate more than 16mmhg and took 541 second to deliver 500mL. The pressure curves are demonstrated in the figure.

CONCLUSIONS: The single action irrigation pump generated the highest pressure when compared to the bulb and the continuous pressure bag. Understanding these differences can help with more directed and purposeful use to help prevent over pressurization and associated complications. More studies can evaluate the clinical effects and significance of these differences in pressure.
ABSTRACTS

ABSTRACT # 36

ENGINEERING BURST WAVE LITHOTRIPSY FOR NONINVASIVE FRAGMENTATION OF URETEROLITHS IN PET CATS

Adam D. Maxwell1,2, Ga Won Kim2, Eva Furrow3, Jody P. Lulich1, Marissa Torre3, Brian MacConaghy2, Elizabeth Lynch2, Daniel F. Leotta2, Yak-Nam Wang2, Michael S. Borofsky4, and Michael R. Bailey1,2
1Department of Urology, University of Washington School of Medicine; 2Center for Industrial and Medical Ultrasound, Applied Physics Laboratory, University of Washington; 3Department of Veterinary Clinical Sciences, University of Minnesota, St. Paul, MN; 4Department of Urology, University of Minnesota, Minneapolis, MN

Introduction: Approximately 70% of cats with chronic kidney disease have nephroliths, ureteroliths, or both. Surgery is recommended for obstructing ureteroliths but carries a 6-18% mortality rate. Burst wave lithotripsy (BWL) is a non-invasive, ultrasound-guided, handheld focused ultrasound technology that successfully and safely disintegrates uroliths in humans and harbor seals. However, the smaller body habitus of the cat requires scaling the technology.

Methods: A numerical simulation tool was developed to use CT image data (human or feline) to assess the optimal focal depth and acoustic window to treat stones with BWL (Figure 1). The typical size of cat ureteroliths and ureters were also determined. These directed the design of the BWL transducer to be built around an imaging probe. Prototypes were fabricated and tested in a benchtop model using 35 natural calcium oxalate monohydrate stones from cats. Associated tissue injury was measured on an acute porcine animal model.

Results: A 650-kHz probe 33 mm in diameter focused 1-3 cm below the skin was designed and fabricated to break stones to ≤1 mm fragments. In an initial experiment of 25 stones, BWL was performed using peak ultrasound pressures of 7.3 (n = 10), 8.0 (n = 5), or 8.9 MPa (n = 10) for up to 30 minutes. Fourteen of 25 stones fragmented to <1 mm within the 30 minutes. In a second experiment of 10 stones, BWL was performed using a second transducer and peak ultrasound pressure of 8.0 MPa for up to 50 minutes. In the second experiment, 9 of 10 stones fragmented to <1 mm within the 50 minutes. Across both experiments, an average of 73-97% of stone mass could be reduced to fragments <1 mm. A third experiment found negligible injury with in vivo exposure of kidneys and ureters in four pigs.

Conclusions: These data support further evaluation of BWL as a noninvasive intervention for obstructing ureteroliths in cats. Such a probe may also fit young pediatric human stone formers or other human applications such as salivary stones, and it enables future transducer design to fit different body habitus or anomalies as needed. Work supported by NIDDK P01 DK043881, NIDDK K01 DK104854, ORIP K01 OD019912, UW Comotion F2022-8524-Bailey, and the EveryCat Health Foundation.

Figure 1. (Left) 3-dimensional rendering of tissue segmented image from CT data, showing the urinary tract, bone structure, and intestinal tract. (Right) Surface rendering of the skin, with green points indicating positions of a 50-mm transducer with a clear acoustic window to the ureteropelvic junction of the left kidney. The pink-yellow scale indicates the skin-to-stone depth at different points along the surface with a clear acoustic path to the stone.
AN AUGMENTED REALITY XR HEADSET IMPROVES HAND-EYE COORDINATION WHEN USED AS THE PRIMARY MONITOR

Nelson Stone¹, ²Steven Griffith, ²Grant Sherman, ²Michael Wilson, ³Vassilios Skouteris, ⁴Jonathan Stone
¹Icahn School of Medicine Mount Sinai, NY, NY, ²Viomerse, Inc, Pittsford, NY, ³Brachytherapy Center, Athens, Greece, ⁴University of Rochester Medical Center, Rochester, NY

Introduction: When minimally invasive surgery replaced open surgery for many urologic procedures it became necessary for surgeons to look at the monitor and not at their hands. Theoretically, by placing the monitor directly in the clinicians’ eyes, urologists could look at the operative site when performing the procedure potentially improving their hand-eye coordination. We sought to test this hypothesis with a headset designed for this function on a prostate phantom.

Methods: The headset contained a 1920 x 1080 resolution webcam and see-through projection optics with a 37.5° field of view (Lumus, Ness Ziona, Israel). The lower portion of the optic is transparent, while the upper portion is a reflective lens that allows for projection of the live ultrasound (US) image. The real-time images were stacked to create an operative field giving the user the impression they could “see” into the US image of the phantom. The headset was tested at the 2022 AUA where urologists were invited to wear it while performing transperineal biopsy on a prostate phantom (figure). Following the procedure urologists were asked to complete a survey of their experience.

Results: Twenty-two urologists responded to 7 questions with a 5-point scale. The majority reported a favorable experience (table). 61.1% and 77.8% agreed or strongly agreed that the headset gave them “see-through” vision and improved hand eye coordination, respectively. 13 thought it could replace the US monitor, 10 the endoscopic and laparoscopic monitors and 6 the fluoroscopic monitor.

Conclusion: This investigation has validated the advantages of a headset accessory monitor system when performing an ultrasound guided prostate biopsy in a phantom. Additional studies in patients will need to be performed to validate its clinical application.

Table1. Survey responses of the headset accessory monitor system after a transperineal prostate biopsy in a phantom. The headset was used instead of the ultrasound monitor.

<table>
<thead>
<tr>
<th>Survey Response</th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comfortable/not distracting</td>
<td>5.6%</td>
<td>22.2%</td>
<td>55.6%</td>
<td>16.7%</td>
</tr>
<tr>
<td>Image bright and clear</td>
<td>11.1%</td>
<td>27.8%</td>
<td>50.0%</td>
<td>11.1%</td>
</tr>
<tr>
<td>See through vision, no additional monitor required</td>
<td>5.6%</td>
<td>33.3%</td>
<td>22.2%</td>
<td>38.9%</td>
</tr>
<tr>
<td>Improved hand-eye coordination</td>
<td>5.6%</td>
<td>16.7%</td>
<td>50.0%</td>
<td>27.8%</td>
</tr>
<tr>
<td>Decreased time to learn procedure</td>
<td>5.6%</td>
<td>16.7%</td>
<td>61.1%</td>
<td>16.7%</td>
</tr>
<tr>
<td>Valuable for remote training</td>
<td>0%</td>
<td>0%</td>
<td>33.3%</td>
<td>66.7%</td>
</tr>
<tr>
<td>Valuable for instructor to see what student sees</td>
<td>5.6%</td>
<td>0%</td>
<td>16.7%</td>
<td>77.8%</td>
</tr>
</tbody>
</table>

Figure1. Urologist wearing augmented reality XR headset
ABSTRACT # 38

DE-NOVO METHOD OF SURGICAL DATA ANALYSIS USING Revo-i® SUB-BLOCK ANALYZER IN CLASSIFYING THE PROCEDURE CHARACTERISTIC WITHOUT IMAGING DATA

Hyung-Joo, Kim M.D., Ph.D.(engineering), You-Jin Lee B.Eng
Surgical Robot Division of Meerecompany Inc.

Introduction: Surgical data are challenging to gather and analyze due to its unstructured, individual, and unquantified nature. Video image analysis is a common approach but requires high computing power and time-consuming annotation, and lacks 3D spatial coordinate data. To address these limitations, the authors proposed the Sub-block analysis approach, which manages data at the sub-block level without image information. This approach was tested for feasibility as a classifier in machine learning.

Methods: The Sub-block analyzer® (SBA) manages robotic data at the sub-block level. The entire space of operation is transformed into a BLOCK defined by a hexahedron and divided into hexahedron sub-blocks containing data on the robot's arm motion. Using 149 peg transfer tests, the study evaluated the capability of sub-block data as a classifier for discriminating between two methods (Switching 106 cases and Non-Switching 43 cases) without imaging data, using the Support Vector Machine (SVM) machine learning algorithm.

Results: At the BLOCK level, there are statistically significant differences in procedure time and the total trace length of robotic arms between the two groups. When procedure time was used as a feature for SVM, sensitivity, specificity, and AUC were 0.36, 0.97, and 0.669, respectively. The results of the total trace length of both arms in the SVM classification were 0.63, 1.00, and 0.818. In the analysis of the sub-block level, the total number of sub-blocks was 27. When trace length data of sub-blocks were used as a feature of SVM classification, sensitivity, specificity, and AUC were 0.93, 1.00, and 0.967 (95% CI: 0.8915, 0.9995). Results of the time of both arms as a SVM feature were 0.75, 1.00, and 0.875 (95% CI: 0.8313, 0.9872) [Table 1]. In order to locate the sub-blocks that contributed to the difference between the two groups, we compare the sub-block data with the Wilcox rank sum test. Results showed there were statistical differences in trace length between the two groups in the sub-block except No. 1, 4, 7, 9, 18, 19, 20, 21, and 22. The positions of these sub-blocks were shown in SBA.

Table 1. Comparison of SVM Machine Learning's classifier capabilities in BLOCK and sub-block Data.

<table>
<thead>
<tr>
<th>Features of SVM</th>
<th>Result of SVM Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Procedure Time</td>
<td>Sensitivity     0.36 Specifity 0.97 AUC 0.669 95% CI 0.7034, 0.9268</td>
</tr>
<tr>
<td>BLOCK Trace length of both arms</td>
<td>Sensitivity 0.63 Specifity 1.00 AUC 0.818 95% CI 0.804, 0.9773</td>
</tr>
<tr>
<td>Sub-block Trace length of both arms</td>
<td>Sensitivity 0.93 Specifity 1.00 AUC 0.967 95% CI 0.8915, 0.9995</td>
</tr>
<tr>
<td>Sub-block Time of both arms</td>
<td>Sensitivity 0.75 Specifity 1.00 AUC 0.875 95% CI 0.8313, 0.9872</td>
</tr>
</tbody>
</table>

Conclusion: This study showed the feasibility of Sub-block analysis in classifying the characteristics of procedure methods, along with sub-blocks contributing to this difference. The sub-block level of feature analysis revealed better classifier capability and reasoning ability than the group level. However, this is a preliminary study performed in a controlled environment using a simulator so as to exclude uncontrolled confounding factors and keep consistency in the test environment. We will conduct additional research to demonstrate whether this approach can describe different sorts of procedural features in different situations.
ABSTRACT # 39

DEVELOPMENT OF A BIOMECHANICAL FEEDBACK SYSTEM FOR FLEXIBLE URETEROSCOPY

Jayson Kemble¹, Laura Torre², Nicholas Hugenberg³, David Holmes III³, Kevin Koo¹
¹ May Clinic Department of Urology; ²Columbia University; ³Mayo Clinic Biomedical Imaging Resource

Introduction: Flexible ureteroscopes (FUS) are the most commonly used surgical device for upper urinary tract pathologies. Single-use flexible ureteroscopes (SU) were introduced in 2015 but their ergonomic impact on surgeons is not well characterized. The aim of this study was to develop and test a biomechanical feedback system to measure SU ergonomics during ureteroscopic training.

Methods: Inertial measurement units (IMU) were used in the creation of a biomechanical feedback glove (BFG). Literature review was conducted to determine proper anatomical placement of IMUs. Testing of the BFG was performed using a widely available SU and an anatomic kidney-ureter-bladder model, with measurements taken from residents from a single urology program while completing a series of 3 simulated tasks.

Results: Four IMU’s were selected to measure force at the right thumb, second finger distal interphalangeal joint, extensor digitorum tendons, and flexor digitorum muscle during ureteroscopy. Pilot testing with eight residents demonstrated reliable measurement of hand kinematics during simulated ureteroscopy. Overall magnitude of force per task was not noticeably different between residents of different PGY years, but time to completion of all tasks was 10.9 minutes in younger residents, compared to 7.1 minutes in older residents.

Conclusion: In this pilot experiment, we successfully developed and tested a biomechanical feedback glove for flexible ureteroscopy. Further testing and refinement may enable validation of real-time feedback during training scenarios to enhance surgical simulation and trainee performance.

![Calculated Magnitudes of Movement for All Subjects](image-url)
ABSTRACT # 40

7.5 VERSUS 8.4/9.4 FR FLEXIBLE URETEROSCOPIES IN THE “NO TOUCH TECHNIQUE” OF RENAL STONE TREATMENT

Geavlete B. 1,2, Multescu R. 1,2, Cosma C. 2, Iordache V. 1,2, Geavlete P. 1,2
1Sanador Hospital; 2“Saint John” Emergency Clinical Hospital, Department of Urology, Bucharest, Romania

Introduction: Large meta-analyses demonstrated that the wires and the access sheaths (UAS) have their specific complications rate during and after flexible ureteroscopy (fURS). So, in selected cases, we applied the “No Touch Technique” (NTT) only by visual insertion and progression of the flexible scope with intrarenal disintegration of the stones.

Material and methods: Between March 2021 and November 2022 a total of 259 patients with single pyelocaliceal stone (the largest diameter between 11 and 23 mm), all not pre-stented, underwent NTT: 129 using 7.5 Fr. ureteroscopes (Group 1) and 130 using 8.4-9.4 Fr. ureteroscopes. For the Group 1 – we used single-use PUSEN – PU 3033A – 79 cases and single-use HugeMed – 50 cases. For the Group 2 we used Olympus URF-V2 (8.5 Fr.) – 44 cases, Storz Flex X2 (8.4 Fr.) – 49 cases, single-use PUSEN PU 3022 (9.5 Fr.) – 38 cases. Stone-free rate was evaluated by noncontrast CT (stones < 2 mm.). We compared the operative time, the hospitalization periods and the complications.

Results: A successful ureteroscopic insertion was 98% in Group 1 and 84% in Group 2. Superficial mucosal ureteral wall lesions at the end of the procedure was 0% for Group 1 and 4.7% for Group 2. The average operative time was slightly higher in Group 2 vs. Group 1 (47 vs. 39 min.). SFRs (stones < 2 mm.) were overall lower in the Group 2 (76.7 vs. 87.1%) at 1 month. At 3 months we didn’t find any significant differences between these 2 Groups. The average urinary tract infection rate was slightly higher in the Group 2 (11 vs 9%). The hospitalization periods were longer in Group 2 vs. Group 1 (21 vs. 29 hours).

Conclusions: NTT seems to be very efficient and safe in the endoscopic treatment of renal stones. This first comparative analysis of NTT using different diameter of the ureteroscopes clearly demonstrates the advantages of 7.5 Fr. ureteroscopes. These new tools maximize the surgical efficiency, the procedure is less expensive (without access sheath and guidewires, less than 350 USD) and minimize the complication rate in ureteroscopic treatment of renal stones.
PASSIVE DEFLECTION OF SINGLE-USE URETEROSCOPE FOR DIFFICULT APPROACHES IN RENAL STONES

Geavlete B. 1,2, Mareș C. 2, Popescu R. 1,2, Mulțescu R., Ene C., Geavlete P. 1,2
1Sanador Hospital; 2“Saint John” Emergency Clinical Hospital, Department of Urology, Bucharest, Romania

Introduction: There are still unique circumstances that make it challenging to achieve the optimum stone treatment in difficult renal anatomy (congenital renal anomalies -horseshoe kidneys, ectopic and rotated kidneys and/or unique intrarenal anatomy – acute infundibulopelvic angle, long infundibular length, etc.). Our objective was to evaluate the new performances, especially passive deflection, of ureteroscopes in such cases.

Material and methods: We analyzed data from 62 patients with pyelocaliceal stones between January 2021 and November 2022: 39 inferior calix, 15 horseshoe kidney, 5 pelvic kidneys, 2 malrotated kidneys, 1 calyceal diverticulum in which the reusable flexible ureteroscopes couldn’t reach the stone (Olympus URF-V2 and Storz Flex X2). The mean age of the patients was 49 years (range 27 to 71 years). The mean stone surface area (SA) was 287 ± 42 mm² (range 146-340 mm²). There were patients with infundibulopelvic angle (IPA) <30° (range 25°) and a long infundibular length (IL) (>3 cm) – range 3.7 cm., or stones located in calyceal aberrant position. We used Uscope Pusen 9.4 Fr. (PU 3022A) and Pusen 7.5 Fr. (PU 3033A) with active and passive deflection (Zhuhai Pusen Medical Technology) - we bent the tip of the ureteroscope by supporting it against the calyx (most frequently) or another intrarenal structure to "passively" orient the ureteroscope optics in the opposite direction). The gravitational pressure system for irrigation was applied in all cases. We evaluated the patients for stone-free rate (SFR), the mean operation time and the complication rate.

Results: After failed approach of the stones using the standard URS, the passive deflection gave us the possibility to reach the stones in 44/62 cases (70.9%), unreachable to the “classic” ureteroscopy and we disintegrated “in situ” these stones (27 in the inferior calix, 10 horseshoe kidney, 4 pelvic kidney, 2 malrotated kidney, 1 calyceal diverticulum). The average operative time was 92±16 minutes. The SFR status (fragments between 1 and 4 mm. being considered residual) was evaluated using CT scan. After one month, the SFR was 77.77% (21/27 inferior calyx stones), 50% (5/10 horseshoe kidney stones), 50% (2/4 pelvic kidney stones), 50% (1/2 malrotated kidney stones) and 100% (0/1) diverticulum pyelocaliceal stones). Clavien I and II occurred in 19/44 cases (43.2%). No major complication was described.

Conclusions: Using the passive deflection, we described stone reaching and disintegration in 44/62 (70.9%) of cases, unreachable to reusable ureteroscopes. In these cases, we change the surgery standard practice. This maneuver realizes a complementary deflection of the ureteroscope (the ureteroscope was pushed more proximally and expanded its tip). According to our experience, waiting for the ureteroscopes with a second active deflection, this technique can give us better results in special cases.
DEVELOPMENT OF A LIQUID BIOPSY USING EXTRACELLULAR VESICLES TO ASSESS THE SYSTEMIC T CELL IMMUNE LANDSCAPE IN BLADDER CANCER

Karen Doersch MD, PhD1*, Samuel Walker, MS2, Thomas Osinski MD1, Jonathan Flax, MD, MBA1,2, James McGrath PhD2

1Department of Urology, University of Rochester Medical Center, Rochester NY
2Department of Biomedical Engineering, University of Rochester, Rochester NY

INTRODUCTION AND OBJECTIVE: Urothelial carcinoma (UC) is commonly treated with therapeutics that target the immune system, such as checkpoint immunotherapy or Bacillus Calmette-Guerin (BCG). While assessment of T cell function is of utility in predicting response to these therapies, current methods for evaluating systemic T cell immunity or intratumoral immune behavior are limited. As antigenically activated T cells produce extracellular vesicles (EVs) carrying markers of cell subtype and activation state and these are found in the blood, we hypothesized that serum T cell derived EVs could be used to interrogate the systemic antitumor T cell response. The purpose of this study was to evaluate a novel microfluidic strategy ‘catch and display for liquid biopsy’ [CAD-LB] for the rapid assessment of T cell biomarkers on individual EVs from T cell conditioned medium or blood.

METHODS: T cell derived EVs from cultured cells. We hypothesized that T cell derived EVs have markers of T cell function that mirror their cell of origin. To test this, we assessed markers of activation and exhaustion on EVs secreted by T cells. Activation and exhaustion were induced in vitro by stimulation with anti-CD3/CD28 beads, mimicking the in vivo stimulation of T cells in an antigen-rich tumor environment. T cell subtype and activation state were assessed by CAD-LB and flow cytometry.

T cell markers on serum EVs. We developed an affinity purification method for CD3+ EVs and subsequently evaluated the level of T cell biomarkers on these using CAD-LB in UC specimens from patients.

RESULTS: 1. T cell marker expression on EVs from conditioned medium from resting, activated and exhausted cells followed the pattern present on the EV producing T cells.
2. T cell derived EVs from UC patient serum identified markers of activated and functionally exhausted cells, indicating that we can capture the full range of T cell functionality.
3. Detected T cell EVs with markers of non-circulating tissue-resident cells (present in tumor, secondary lymphoid and peripheral tissue) that EVs capture the systemic immune responses.

CONCLUSIONS: T cell-derived EVs capture the phenotype and identity of their cell of origin. CAD-LB detects a range of T cell populations in serum. Future work will test if T cell EVs capture tumor and systemic antitumor immunity, which may help identify UC patients more likely to respond to immunotherapy.
ONCOLOGICAL AND FUNCTIONAL OUTCOMES OF SALVAGE CRYOTHERAPY FOR THE MANAGEMENT OF PROSTATE CANCER BIOPSY-PROVEN RECURRENCE AFTER PRIMARY BRACHYTHERAPY VERSUS PRIMARY CYROTHERAPY: A PROPENSITY SCORE-MATCHED ANALYSIS

Sriram Deivasigamani*1, Hazem Orabi*1,2, Ahmed El-Shafei3, Eric S Adams1, Srinath Kotamarti1, Ali Aminsharifi1,4, Leah Davis1, Yuan Wu5, J Stephen Jones6, Thomas J. Polascik1

1Department of Urologic Surgery and Duke Prostate Center, Duke University Medical Center, Durham, NC; 2Urology Department, Assiut University, Egypt; 3University of Florida Health, Department of Urology, Jacksonville, FL; 4Department of Urology, Penn State Health Milton S. Hershey Medical Center, Hershey, PA; 5Duke Cancer Institute and Department of Statistics, Durham NC; 6Inova Health System, Falls Church, VA

Introduction: Salvage cryotherapy (SCT) is widely used to treat prostate cancer recurrence after radiotherapy (RT). We determined the intermediate oncological and functional outcomes of patients who underwent SCT after primary brachytherapy (BT-SCT) or primary cryoablation (CRYO-SCT), as well as the effects of primary therapy on its outcome.

Methods: An IRB-approved cohort study utilizing patient data from the Cryo On-Line Data (COLD) Registry and the Duke Prostate Cancer database was retrieved retrospectively between 1992 and 2016. Biochemical recurrence (BCR) using Phoenix criteria was the primary endpoint assessed at 2- & 5 years post SCT. Secondary endpoints assessed functional outcomes including urinary continence, erectile function and recto-urethral fistula. Association between treatment and biochemical progression-free survival (BPFS) was assessed using inverse probability weighted (IPTW) Cox proportional hazards regression. The differences in the secondary functional outcomes were assessed by Pearson's χ² test or Fishers exact test, corrected for IPTW.

Results: 194 unweighted subjects were included who had complete data for the primary analysis. There was no statistical difference in 2-year BCR (HR 0.9; 95% CI, 0.5–1.7) or 5-year BCR (HR: 0.86; 95% CI, 0.5-1.5) between the 2 groups. There was no statistical difference between the 2 groups regarding the adverse functional outcomes, although the incidence of urinary incontinence was higher in BT-SCT than in CRYO-SCT.

Conclusion: SCT after cryotherapy failure appears to be well tolerated, with comparable oncological and functional outcomes to patients failing primary brachytherapy. The findings also demonstrated that SCT can render a significant number of patients biochemically free of disease after initial cryotherapy with minimal morbidity. SCT is a viable treatment option to salvage local prostate cancer recurrence following either brachytherapy or primary cryoablation failure.
ABSTRACTS

ABSTRACT # 44

RECONCILING DISCORDANCE BETWEEN PIRADS-4 LESIONS AND TARGET BIOPSY HISTOLOGY- EARLY EXPERIENCE WITH A STRUCTURED MULTIDISCIPLINARY QUALITY IMPROVEMENT PROTOCOL AND PI-RADS 4 SUBCATEGORIZATION

Sriram Deivasigamani*, Srinath Kotamarti*, Eric S. Adams¹, Denis Séguier¹,², Dylan Zhang³, Zoe Michael¹, Thomas J. Polascik MD¹,⁴, Rajan T Gupta MD¹,³,⁴
¹Duke University Medical Center, Department of Urologic Surgery and Duke Prostate Center, DUMC Box 2804, Durham, North Carolina 27710; ²Department of Urology, Lille University Hospital, Lille, France; ³Duke University Medical Center, Department of Radiology, DUMC Box 3808, Durham, North Carolina 27710; ⁴Duke Cancer Institute Center for Prostate and Urologic Cancers, DUMC Box 103861, 20 Duke Medicine Circle, Durham, NC 27710 USA

Introduction: PI-RADS 4 lesions are considered to have a “high” likelihood of clinically-significant prostate cancer (csPCa). However, patients undergoing targeted biopsy have a range of histologic findings. Understanding discordant cases where such lesions do not reveal csPCa post-biopsy is critical to improve diagnostic accuracy and inform subsequent management. Herein, we studied early findings from implementation of a multidisciplinary Quality Improvement (QI) protocol for reconciling discordance and evaluated the potential heterogeneity of PI-RADS 4.

Methods: Patients with mpMRI PI-RADS 4 lesions undergoing fusion-targeted biopsy from Jan 2017 to May 2021 were retrospectively reviewed. The discordant targeted biopsy pathology (benign/GG1) was evaluated utilizing a QI protocol and all lesions were subcategorized based on ADC values. Positive Predictive Value (PPV) for PI-RADS 4 lesions overall and the Cancer Detection Rate (CDR) for subcategorized lesions were calculated.

Results: 248 patients with 286 lesions were reviewed. Prior to re-review, PI-RADS 4 PPV for ≥ GG1 and ≥ GG2 lesions were 0.55 and 0.34, increasing to 0.67 and 0.43 following reconciliation. Lesion subcategorization based on ADC value as higher suspicion (4+) and lower suspicion (4-) resulted in 158 and 117 lesions, with reverse-fusion analysis revealing that 61% and 17% of lesions contained csPCa, respectively. Subgroup analysis among PI-RADS 4+ lesions led to an increase in the CDR to 75% and 61% for ≥ GG1 and ≥ GG2. Limitations include retrospective design and single-center study.

Conclusion: Use of a multidisciplinary QI protocol to review discordance cases between PI-RADS 4 lesions and histology improves diagnostic accuracy and guides subsequent management. Our findings highlight the known heterogeneity of this category with reference to csPCa CDR, suggesting the potential value of PI-RADS 4 subcategorization.
ABSTRACTS

ABSTRACT # 45

TOP 10 ABSTRACT

IN-VIVO THERMAL TISSUE MAPPING IN A PORCINE MODEL DURING LASER ACTIVATION

Ron Marom¹, Julie J. Dau¹, Timothy L. Hall², Khurshid R. Ghani¹, William W. Roberts¹,²
¹ Department of Urology, University of Michigan, Ann Arbor, MI, USA
² Department of Biomedical Engineering, University of Michigan, Ann Arbor, MI, USA

Introduction: Higher power laser settings can yield smaller stone fragments and faster endoscopic treatments but also impose a thermal risk to the surrounding healthy renal tissues. While high fluid temperatures have been seen in both in-vitro and in-vivo studies with laser lithotripsy, the thermal distribution within the renal parenchyma has not been characterized. Additionally, the heat-sink effect of vascular perfusion remains uncertain. In this in-vivo study we sought to map the renal temperature distribution in response to laser activation in a calyx in both perfused and non-perfused states.

Methods: Ureteroscopy was performed in a porcine model with a prototype ureteroscope containing a temperature and a pressure sensor at its tip. The distal end of the ureteroscope was positioned in the middle of a calyx and maintained there for the entire experiment. A multi-point needle with four thermocouple sensors located 5, 15, 25, and 35 mm from the tip was introduced percutaneously into the same calyx using US guidance. The first sensor was positioned inside the calyx. Three trials of 60 second laser activation (40 W) were conducted with irrigation of 8 ml/min. After euthanasia, three trials with the same settings were repeated. Thermal dose was calculated from the time-temperature curves for each thermocouple using the Sapareto and Dewey methodology. The threshold of thermal tissue injury was considered to be $t_{43} = 120$ equivalent minutes.

Results: The collecting system fluid temperature increased by over 30 °C and surpassed the thermal threshold in all trials. The temperature at the second thermocouple in the medulla increased to a lesser degree, but still surpassed thermal threshold in some trials. Comparing perfused and non-perfused trials, temperature curves were similar except at the 3rd thermocouple in the renal cortex where temperatures increased much more without perfusion.

Conclusion: High-power laser settings (40 W) with lower irrigation rates can induce potentially injurious temperatures in the in-vivo porcine model, particularly in the region adjacent to the collecting system. Furthermore, vascular perfusion appears to have limited effect on mitigating thermal spread in the medulla.

Funding: Research grant from Boston Scientific & University of Michigan Urology Faculty Catalyst Award

Disclaimer: Prototype ureteroscope used in this study was a concept device/technology, which was not available for sale at the time the study was conducted. Pre-clinical study results may not necessarily be indicative of clinical performance.
EXTRACAPSULAR EXTENSION RISK ASSESSMENT USING AN ARTIFICIAL INTELLIGENCE PROSTATE CANCER MAPPING ALGORITHM

Alan Priester1,2, Sakina M. Mota2, Joshua Shubert2, Shyam Natarajan1,2, Wayne G. Brisbane1
1 University of California, Los Angeles; 2 Avenda Health, Inc.

Introduction: The presence of extraprostatic extension (ECE) is critical to risk stratification and treatment of prostate cancer (PCa), but current techniques for prediction of ECE are imperfect. Herein we assess usage of an artificial intelligence (AI) cancer mapping algorithm for improved ECE risk assessment.

Methods: Consecutively accrued patients who received preoperative multiparametric MRI, confirmatory biopsy, and subsequent prostatectomy were evaluated (N = 121). A radiologist prospectively interpreted the MRI, defining regions of interest (ROIs) suspicious for PCa and ECE risk via a Likert scale. Following prostatectomy, a pathologist determined if and where ECE occurred using whole-mount slides (Figure 1B).

An FDA-cleared AI cancer mapping algorithm (Unfold AI, K221624) was investigated for ECE prediction. The algorithm incorporated T2-weighted MRI, serum prostate specific antigen (PSA), and biopsy pathology to generate 3D cancer estimation maps for each case. ECE risk was estimated as the total cancer probability of voxels intersecting and up to 2 mm beyond the prostate capsule (Figure 1A). For comparison, conventional metrics were also assessed: Gleason Grade group (GG), serum PSA, MRI Likert score, Partin table value, and ROI capsular contact length. A receiver operator characteristic was generated for each metric, and areas under the curve (AUCs) were compared using DeLong’s test at α = 0.05.

Results: The distribution of GG on final diagnosis was 13% GG1, 56% GG2, 16% GG3, 9% GG4, and 6% GG5. ECE was present in 46/121 cases; of these, 76% had posterior ECE only, 15% had anterior ECE only, and 9% had both. The receiver operator characteristic for patient-level ECE prediction is shown in Fig C. The AUC of AI (0.88) was significantly higher (p < 0.001) than PSA (0.60), GG (0.68), MRI Likert score (0.71), and Partin tables (0.65). The AUC of AI was likewise higher than ROI contact length (0.83), an improvement that was suggestive but insufficient for statistical significance (p = 0.10).

Conclusions: Unlike conventional ECE predictors, AI can combine multi-modal data to map cancer risk in 3D. This approach shows promise as a means of ECE prediction, surpassing conventional methodology such as Partin tables and subjective MRI interpretation. Clinicians furnished with AI-generated ECE risk assessments could more precisely manage prostate cancer, improving patient outcomes and quality of life.

Figure 1. (A) Exemplary AI-generated cancer estimation map, wherein the cancer probability of voxels intersecting and beyond the capsule was used to make an objective assessment of ECE risk. (B) Exemplary ground truth histopathology slide wherein ECE was observed in the prostate anterior, the highest-risk region identified by the AI algorithm. (C) Receiver operator characteristic for patient-level prediction of ECE using AI and conventional metrics.
A NOVEL PROSTATE BIOPSY SYSTEM FOR HIGH QUALITY BIOPSY SAMPLES FOR COMPUTATIONAL PATHOLOGY

Jeffrey Proctor¹, Dan Wiener², Bela Denes³
¹Georgia Urology, Atlanta GA, ²DXW Pathology Associates, Acworth, GA, ³Laguna Beach, CA

Introduction: Risk stratification of prostate cancer is primarily based on the Gleason scoring system and is currently reported on microscopic inspection and evaluation of tissue histology fixed on glass slides. Recent articles have highlighted the importance of core quality of needle biopsies in the era of precision medicine.

Computational Pathology/Artificial Intelligence and digital pathology are widely expected to become an increasingly important tool in the diagnosis of prostate cancer. The quality of the biopsies and their whole slide images (WSI) can have a significant impact on the ability of these algorithms to perform accurately. Standards are therefore being developed to evaluate the quality of whole slide images analyzed by computer algorithms such as Artificial Intelligence.

We conducted a pilot study using novel 18ga prostate biopsy needle that has been demonstrated to sample significantly more tissue volume per core by weight than currently used standard of care needles, 12% in transrectal ultrasound guided biopsy (TRUS) and 21% in MRFUS Trans-perineal Biopsy (TPUS). Given that tissue retrieval of biopsy cores can also impact tissue quality (fragmentation, tortuosity, etc.), retrieval of specimens from the novel needle utilized a previously reported and described novel “touch & go” method that eliminates tissue handling and does not compromise core integrity. Whole slide images from samples using the novel system (Test) were compared with the standard of care (SoC) needle and SoC retrieval methods. (Control). An AI software, DeepDx Prostate CNB [https://deepbio.co.kr/page/products/prostate-cnb/] was used to measure and report the physical parameters of the specimens.

Methods: 4 men undergoing TRUS were enrolled in the study. In each patient, the left lobe of the prostate was sampled with the novel system and the right, with SoC.

Results: The following are results 48 pairs of tissue cores from 4 TRUS procedures.

<table>
<thead>
<tr>
<th>Total Tissue Area (mm²)</th>
<th>Control</th>
<th>Test</th>
<th>△</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>7.6371</td>
<td>12.7300</td>
<td>67%</td>
</tr>
<tr>
<td>Variance</td>
<td>2.3454</td>
<td>4.8315</td>
<td></td>
</tr>
<tr>
<td>n</td>
<td>24</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>p&lt;.001</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tissue Length (mm)</th>
<th>Control</th>
<th>Test</th>
<th>△</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>14.4083</td>
<td>19.6458</td>
<td>36%</td>
</tr>
<tr>
<td>Variance</td>
<td>7.1573</td>
<td>7.8443</td>
<td></td>
</tr>
<tr>
<td>n</td>
<td>24</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>p&lt;.001</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Conclusion: In this pilot head-to-head comparator study, whole slide images from samples collected by the novel prostate biopsy needle and tissue retrieval systems obtained significantly larger and longer cores. These differences are clinically important since increased tissue area and length in prostate biopsy have been associated with increased cancer detection rates. Additional studies are continuing to assess the impact and utility of this novel biopsy system on quantitative and qualitative aspects of histologic processing and diagnosis using computational pathology.
ABSTRACT # 48

INITIAL EXPERIENCE WITH 3D-ULTRASOUND GUIDED CRYOABLATION OF THE PROSTATE

Harry Anastos¹, Dallin Busby¹, Basil Kaufmann¹,², Matthieu Polverel³, Niranjan Nayar³, Antoine Leroy³, Mani Menon¹, Michael A. Gorin¹

¹Department of Urology, Icahn School of Medicine at Mount Sinai Hospital, New York, NY, USA
²Department of Urology, University Hospital of Zurich, Zurich, Switzerland
³KOELIS, Inc. Grenoble, France

Introduction: Prostate cryoablation is associated with a high rate of in-field treatment failure due to failure to generate ice of sufficiently low temperatures to result in cell death throughout the intended treatment area¹,²,³. To overcome this limitation, the third generation KOELIS Trinity platform (KOELIS, Inc., Grenoble, France) has been proposed to address this limitation by using 3D-ultrasound technology to map the locations of lethal ice formation relative to the intended treatment volume.

Methods: In this study, we report on our initial experience using 3D-ultrasound guidance in combination with the CryoCare CS system (Varian, Palo Alto, CA) to perform prostate cryoablation. The KOELIS treatment planning software was used to place 2.3mm variable-length cryoprobes and determine the number, placement locations, and depths of probes until a predicted temperature of less than -40°C was reached throughout the intended treatment volume. Two freeze cycles were performed in all cases.

Results: Between March 2021 and April 2022, a total of 12 patients underwent the procedure, with 8 (66.7%) undergoing subtotal prostate ablation for primary prostate cancer treatment and 4 (33.3%) for radiorecurrent disease. Median follow-up was 5 months, during which median prostate-specific antigen decreased from 8.4 ng/mL pre-ablation to 1.1 ng/mL (range 0.01 to 6.0 ng/mL). All 11 patients who underwent a post-ablation multiparametric MRI within 8 weeks of treatment, had shown a perfusion defect in the intended areas of ablation. Of the 9 (75%) patients who underwent a post-ablation biopsy, 2 (22.2%) had residual grade group 1 prostate cancer within the area of ablation. Both patients underwent treatment for grade group 2 disease, which was no longer present after ablation.

Conclusion: The use of 3D-ultrasound technology and advanced treatment planning software facilitated successful prostate cryoablation in our study. This technology has the potential to improve the efficacy of cryoablation and may provide urologist with a valuable tool to optimize treatment.

Figure 1: Treatment outcomes of prostate cryoablation with 3D-ultrasound based treatment planning
THE ROAD TO ROBOTIC MINI-PERCUTANEOUS NEPHROLITHOTOMY (PCNL): INITIAL CLINICAL EXPERIENCE OF PCNL COMBINING URETEROSCOPIC (URS) LITHOTRIPSY WITH SYNCHRONOUS PERCUTANEOUS EVACUATION OF FRAGMENTS

Mihir M. Desai¹, Abhishek Singh², Ravindra Sabnis², Arvind Ganpule², Mahesh Desai², Nancy L. Sehgel³, Naomi Kibrya³, Chiara Gatti³, Philippe Grange³, Roshan Patel⁴, Pengbo Jiang⁴, Jaime Landman⁴
¹USC Institute of Urology; ²Muljibhai Patel Urological Hospital; ³Ethicon, Research & Development; ⁴University of California Irvine

Introduction: We describe the initial clinical experience with an innovative PCNL approach combining a percutaneous catheter for stone immobilization and fragment removal, URS lithotripsy, and integrated fluid management of irrigation and suction. We performed ten manual PCNL with this approach, and an initial clinical experience (N=1 patient), with the MONARCH™ Platform, Urology robotic system (Ethicon, Redwood City, CA).

Methods: Procedures were performed in a modified supine position. Percutaneous access was gained in manual cases with fluoroscopic guidance, and in the robotic case with a novel electromagnetic (EM) guidance system. An 18Fr percutaneous sheath was placed for deployment of the steerable flexible 15 Fr suction catheter, and stone visualization and ablation were ureteroscopic. In the robotic case, both the suction catheter and ureteroscope were robotically driven via a hand-held robotic controller. This controller was also controlled a third-party laser, robotic basket, as well as a novel irrigation and aspiration system. In several of the cases, the suction catheter was used to relocate stones into a more favorable location and to immobilize the stone fragments during URS lithotripsy.

Results: In the manual group, ten patients [median (range) age 38 (19-71) years, BMI of 21 (14-36) kg/m², and stone burden of 1.8 (0.9-3.7) cm] were treated with 9/10 (90%) true stone free rate at 30-days post-procedure, assessed with thin slice CT imaging. With the robotic procedure, a single patient [age 69, BMI 34 kg/m², and linear stone burden 4.6 cm], was treated at UCI Medical Center. In the robotic mini-PCNL EM guided access was achieved through the papilla with a single stick, and successful management of all stones, including an impacted stone UPJ stone, was achieved. Thin slice CT on POD30 confirmed a single 1mm lower pole stone fragment. To date, all manual and robotic procedures have been technically successful, without any device-related complications.

Conclusion: Initial clinical experience demonstrates early promise of the aspiration catheter mini-PCNL with URS lithotripsy approach in delivering higher true stone-free outcome for patients. Very early robotic mini-PCNL experience shows technical feasibility, with possible simplification of percutaneous access with the novel EM guidance system as well as the completion of the entire procedure and control of all retrograde and antegrade instruments by a single urologist.
ABSTRACT # 50

INITIAL REAL-WORLD EXPERIENCE OF URETEROSCOPIC LITHOTRIPSY USING THE LithoVue™ ELITE SYSTEM WITH INTRARENAL PRESSURE MONITORING CAPACITY

Kyochul Koo, Abdulghafour Halawani, Victor KF. Wong, Naeem Bhojani, Ben H. Chew
University of Montreal; University of British Columbia

Purpose: The increment of intrarenal pressure (IRP) during ureteroscopic lithotripsy is considered to deteriorate surgical outcomes. Nevertheless, factors associated with increments in IRP and its acceptable thresholds are not well understood. We report our initial experience with the LithoVue™ Elite system with IRP monitoring capacity.

Methods: A single-arm retrospective observational analysis was performed on 46 patients who received ureteroscopic lithotripsy using the LithoVue™ Elite system between April and October 2022. Ureteral access sheath (UAS) was placed at the physician’s discretion. Spiking pressures that exceeded threefold ratios from previous values that persisted for less than 3 seconds were considered artifacts and were removed from the analysis. Median and maximum IRPs, and relative cumulative time exceeding 20, 40, 60, 80, 100, 120, 140, 160, and 200 mmHg per total procedure time were analyzed. The two-sample Mann-Whitney U-test was used with a statistical significance set at \( p < 0.005 \).

Results: Median patient age and body mass index (BMI) were 62.5 (IQR 47.8–72.0) years and 29.4 (23.3–32.8) kg/m\(^2\), respectively. During the median total procedure time of 31.9 (IQR 17.4–44.9) minutes, median and maximum IRPs of 30.0 (IQR 21.0–51.5) mmHg and 177.0 (IQR 129.0–266.0) were observed, respectively. IRP sustained below 60 mmHg during 91.3% of the total procedure time (Figure 1). Patients with Asian ethnicity and hypertension exhibited longer relative cumulative time ≥20 mmHg than their counterparts, while patients with tight ureters and no UAS use exhibited longer relative cumulative time ≥60 mmHg than their counterparts. The use of 11/13 Fr and 12/14 Fr UAS conferred shorter relative cumulative time ≥40 mmHg compared to the use of 10/12 Fr UAS. Age, pre-stenting, preoperative \( \alpha \)-blockade, and BMI did not show any associations with IRPs.

Conclusions: Preemptive measures such as UAS placement can be considered for patients with tight ureters, hypertension, and Asian ethnicity since these patients are prone to increments in IRP.

Figure 1. Distribution of procedure time according to intrarenal pressure ranges.
FIRST-IN-SEAL KIDNEY STONE TREATMENT IN THE HARBOUR SEAL: RESULTS FROM COMBINED NOVEL BREAK WAVE LITHOTRIPSY AND URETEROSCOPY

Ben H. Chew, Jean Buckley, Victor K.F. Wong, Abdulghafour Halawani, Kyo Chul Koo, Doug Corl, Paul Fasolo, Martin Haulena, Oren Levy
University of British Columbia, Vancouver, BC

Introduction: Harbour seals (*Phoca vitulina*) are marine mammals that obtain a majority of their hydration by metabolism of fat stores and directly from prey. Renal calculi have been reported in both free-ranging harbour seals as well as those living under human care. Chronic dehydration and diet may lead to development of kidney stones. Harbour seals have a unique multilobed reniculated kidney anatomy consisting of numerous collection systems that funnel into a common renal pelvis and ureter. Four harbour seals currently reside at the Vancouver Aquarium. One animal died from renal failure approximately 10 years ago. Post-mortem revealed extensive renal calculi resulting in renal damage. An additional seal, named Hermes, was recently diagnosed with extensive renal calculi via sonography and computed tomography (CT)(Figure 1). We describe a multi-team approach to dealing with stones in the harbour seal.

Methods: The 71 kg male seal was given a general anesthetic and placed in the right lateral decubitus position to allow simultaneous access to the flank and penile urethra. Break Wave lithotripsy (Sonomotion Inc, San Mateo, CA) was performed. Ureteroscopy was carried out using a single use digital ureteroscope (LithoVue, Boston Scientific, Marlborough, MA) through an 11/13Fr 46 cm ureteral access sheath. A degradable ureteral stent (URIPRENE, ADVA-Tec, South Carolina) was prepared for post-operative drainage and would not require subsequent removal.

Results: Break Wave Lithotripsy was performed non-invasively on several stones in the left kidney at pressure levels of 8 MPa, the pressure dose level typically used in humans. Real time ultrasound image guidance from the SonoMotion Break Wave system showed complete fragmentation of the primary targeted 1 cm stone which was confirmed on postoperative CT scan. In addition, numerous stones in the vicinity of the main stone targeted were also reduced substantially or were not observed in the postoperative CT scan. The seal had gross hematuria and an uneventful recovery. Simultaneously, retrograde ureteral access took a prolonged time due to the tortuous urethra and ureter. After 90 minutes the ureteroscope finally reached the renal pelvis but the seal became unstable under anesthesia so the ureteroscopic procedure was abandoned.

Conclusion: Non-invasive Break Wave Therapy is an effective tool to treat nephrolithiasis in sea mammals under general anesthesia. The tortuosity of the urethra and ureter make endoscopic access difficult (but not impossible).
ABSTRACTS

ABSTRACT # 52

ANASTOMOSES IN SINGLE-PORT ROBOT-ASSISTED KIDNEY ALLOTRANSPLANTATION

Roxana Ramos\textsuperscript{1}, Patrick D. Michael\textsuperscript{1}, Jaya S. Chavali\textsuperscript{1}, Ethan Ferguson\textsuperscript{1}, Nicolas Soputro\textsuperscript{1}, Mohamed Eltemamy\textsuperscript{1}, Jihad Kaouk\textsuperscript{1}

\textsuperscript{1}Glickman Urological & Kidney Institute, Cleveland Clinic, Cleveland, OH

Introduction: The novel single-port (SP) robotic extraperitoneal approach to kidney transplantation (ROKIT) has proven safety, feasibility, and promising early graft function. We aim to describe the modified suturing technique for the vascular and ureterovesical anastomoses.

Methods: Analysis of the first consecutive SP ROKIT cases performed in one institution. After positioning, incision, blunt dissection of the extraperitoneal space, and robot docking, the right external iliac artery (EIA) and vein (EIV) are identified and dissected. The vascular anastomosis starts with clamping of the EIV with straight Bulldog Clamps (Scanlan International Inc., MN). After inserting the donor kidney in the correct orientation, a 1 cm venotomy is created using monopolar scissors. The anastomosis is performed with two 8-inch long 6-0 GORE-TEX sutures (W. L. Gore & Associates, Inc., AZ) in an end-to-side fashion, with a separation of \( \sim 1 \) mm between each suture point. Once the venous anastomosis is completed, the graft renal vein is clamped, and the EIV is unclamped. Then, the EIA is clamped (first cranially and second caudally) and a 5-7 mm arteriotomy is done with monopolar scissors or an arterial punch. The arterial anastomosis is done with the same technique as the venous anastomosis. After completion of the arterial anastomosis, the graft renal artery is clamped. All clamps are removed from low to high pressure vessels. Anastomotic hemostasis is confirmed. Next, the transplanted kidney is positioned in the retroperitoneal space laying on the psoas muscle. For the ureterovesical anastomosis, the bladder is filled with saline and a 1 cm anterior-lateral full-thickness cystotomy is done. Using two 8-inch long 4-0 Polysorb sutures (Medtronic, MN), the ureteral implantation starts posteriorly and continues in a running bidirectional fashion. The sutures are tied together and water tightness is confirmed by filling the bladder. Wound closure is done in layers.

Results: A total of 20 cases were completed successfully without intraoperative complications. The mean and standard deviation of operative time, vascular anastomoses time, and ureterovesical anastomosis time were 339.8 \( \pm \) 87.4, 44.7 \( \pm \) 8.3, and 28.1 \( \pm \) 11.0 minutes, respectively. On average, vascular anastomosis time decreased by 0.8 minutes for each successive case performed. Postoperatively, one patient required blood transfusion.

Conclusion: The SP ROKIT anastomotic technique described provides a safe and feasible approach to kidney transplantation. Efficiency is improved with gained experience.

Figure 1. Anastomoses in Single-Port Robot-Assisted Kidney Transplant
ASSIST-U: A SYSTEM FOR SEGMENTATION AND IMAGE STYLE TRANSFER FOR URETEROSCOPY

Daiwei Lu¹, Yifan Wu¹, Ayberk Acar¹, Xing Yao¹, Jie Ying Wu¹, Nicholas Kavoussi², Ipek Oguz¹
¹Dept. of Computer Science, Vanderbilt University.; ²Dept. of Urology, Vanderbilt University Medical Center, Nashville, TN

Introduction: Realistic, patient-specific simulators can facilitate both surgical training and preoperative planning for complex procedures[1]. There are many patient-specific simulators for robotic and laparoscopic surgery [2,3]. However, despite its wide utilization, there are no patient-specific simulators to facilitate training or surgical rehearsal for endoscopic kidney surgery. We propose ASSIST-U, a system to automatically create realistic subject-specific endoscopic images and videos solely using preoperative CT images and ureteroscopy videos from other patients to create patient-specific simulations for endoscopic kidney surgery.

Methods: We trained a 3D UNet model to automatically segment CT images of 17 patients and construct 3D surfaces. The 3D surfaces were used to calculate a centerline skeleton. We generated the skeleton by propagating a wave across the surface meshes following a method from computer graphics literature[4]. We sampled points along the skeleton to obtain camera positions and create a 3D rendering of the model. Finally, we trained a style transfer model that translates images from the 3D rendering using CycleGAN to synthesize realistic ureteroscopy images [5] (Figure). Training is performed by generating synthetic images and evaluating them compared to real ureteroscopy frames (31 videos from 21 patients with 12,221 frames extracted). We evaluated our segmentation models using Dice coefficient to measure overlap with expert segmentations, and style transfer models with Frechet inception distance assess the quality of generated images.

Results: We demonstrated style transfer and developed simulations in three patients. Cross validation on the Unet CT segmentation model achieved a mean Dice coefficient of 0.853 ± 0.084 during six-fold cross-validation. CycleGAN style transfer produced visually plausible images; the Frechet Inception Distance to real ureteroscopy images was reduced from 357 (from 3D rendering) to 214 (synthesized) suggesting that the synthesized images are similar to real ureteroscopy images. The style transfer model was able to create the patient-specific simulation in less than one minute.

Conclusion: The proposed ASSIST-U system shows promise for creating realistic, patient-specific simulations for endoscopic kidney surgeries. Such a system could facilitate training and preoperative planning for complex surgeries.

Figure 1. ASSIST-U pipeline. We begin by segmenting the pre-operative CT image. Next, we skeletonize the segmentation result. We use points on the skeleton (e.g., the red circle) as camera points for 3D rendering. Finally, we use style transfer to synthesize realistic ureteroscopy images, supervised by the real ureteroscopy data. This figure illustrates the actual results from a patient that has been run through our entire pipeline. Notably, the real ureteroscopy image (far right) suffers from a partial camera occlusion, whereas our synthesized ureteroscopy frame still demonstrates visualization of the local anatomy.
INVESTIGATION OF BLADDER BIOMECHANICS USING URO-DYNAMIC MIR

Juan Pablo Gonzalez-Pereira1,2, Shane Wells2,3, Wade Bushman3, Alejandro Roldan-Alzate1,2,4

1 Department of Mechanical Engineering, University of Wisconsin-Madison; 2 Department of Radiology, University of Wisconsin-Madison
3 Department of Urology, University of Wisconsin-Madison; 4 Department of Biomedical Engineering, University of Wisconsin-Madison

Introduction: Voiding physiology is most studied with video-urodynamics. Its limitations include (1) inability to simultaneously measure pressure in the bladder and at multiple positions along the urethra and (2) lack of high resolution volumetric and quantitative imaging data. We describe the use of dynamic MRI to non-invasively assess changes in the lower urinary tract (LUT) anatomy during voiding in a healthy male volunteer.

Methods: MRI was performed on an asymptomatic healthy man (55) using a clinical 3T scanner according to an IRB-approved protocol, acquiring bladder images every 4.72 s during voiding. Segmented anatomical volumes, using MIMICS (Materialise, Leuven, Belgium) were used to quantify total voided volume (TVV), post void residual (PVR), volumetric displacement of urine over time, sphericity index, and bladder neck angle throughout the voiding effort.

Results: Increasing sphericity index, indicating a shape change from a vertical ellipse toward a more spherical shape, correlates positively with flow rate (Figure 2). Voiding was accompanied by descent and opening of the bladder neck, with the greatest degree of bladder neck funneling correlated with the maximum urine flow rate.

Conclusion: These observations highlight the unique power of dynamic MRI to provide completely noninvasive assessment of lower urinary tract anatomy and biomechanics during voiding.

Figure 2: A) Sagittal contour lines of the bladder lumen during voiding. B) Bladder neck angle at maximum flow.

<table>
<thead>
<tr>
<th>TVV (cc)</th>
<th>PVR (cc)</th>
<th>Qmax (cc/s)</th>
<th>Qavg (cc/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>683</td>
<td>357</td>
<td>11.2</td>
<td>5</td>
</tr>
</tbody>
</table>

Figure 2: (Left) Urine flow curve determined by time-dependent changes in calculated bladder volume with additional calculated metrics shown below. (Right) Color-coded sphericity index increasing (red) and decreasing (blue) with maximum flow (black triangle).
PROSTATE CANCER DIAGNOSIS WITH MICRO-ULTRASOUND – A PILOT CLINICAL STUDY

J. Pensa1, W. Brisbane1, A. Priester1, A. Sisk2, E. Felker3, L. Marks1, R. Geoghegan1
1 University of California, Los Angeles. Department of Urology; 2 University of California, Los Angeles. Department of Pathology; 3 University of California, Los Angeles. Department of Radiology

Introduction: Conventional ultrasound (US) has poor sensitivity and specificity for detecting prostate cancer (PCa) [1]. Magnetic resonance imaging (MRI) is more effective, but is resource intensive and can significantly underestimate tumor volumes [2,4]. Recently, high-resolution ultrasound, referred to as micro-ultrasound (microUS), has been introduced and preliminary studies indicate similar performance to MRI for visualizing PCa [5,6]. Here, we present preliminary results for blinded delineation of PCa on microUS and MRI by expert reviewers validated by ground truth whole-mount (WM) pathology.

Methods: Ten subjects undergoing radical prostatectomy with a pre-operative multi-parametric MRI were enrolled in the study. In the operating room prior to surgery, patients received an in vivo microUS scan of their prostate. Following the surgery, a second, ex vivo microUS scan was performed on the resected prostate to aid with registration. The prostate was placed in a patient-specific mold for axial plane alignment, submerged in a saline imaging tank, and scanned from apex to base using a microUS probe mounted to a translation stage. The prostate was then placed in a pathology mold, grossed, sectioned, and digitally scanned to produce slides in the same orientation as the MRI and microUS scan, as described in earlier studies [7]. Blinded expert reviewers delineated suspicious regions on one of either: microUS, MRI, or pathology. Matched corresponding images from both T2 MRI and ex vivo microUS were chosen for each histology slide. An experienced urologist cognitively transferred the in vivo microUS annotations to the ex vivo microUS images while remaining blinded to WM pathology. Using the prostate capsule, rigid registration followed by thin-plate spline (TPS) non-rigid registration was performed to co-register both microUS and MRI annotations to each WM pathology slide.

Results: MicroUS and MRI annotations were co-registered on a total of 53 WM slides (Fig. 1A). Only clinically significant lesions were considered (Gleason Grade >= 3+4). A total of 14 lesions were present (10 index lesions). A cross-section (2D slice) of one of these 14 lesions was present on a WM slide 49 times. All ten (100%) index lesions were identified on microUS and MRI (Fig. 1B). Out of all 14 lesions, microUS and MRI identified 12 (86%) and 11(79%) respectively. Additionally, microUS identified more lesion cross sections (representative of tumor extent) than MRI (40/49 [82%] vs 26/49 [53%]) but also had substantially more false positives (32/71 [45%] vs 5/31 [16%]).

Conclusion: MicroUS and MRI were able to identify all ten index lesions. For this dataset, microUS demonstrated improved sensitivity, identifying one additional lesion and more of the tumor extent than MRI, but reduced specificity with significantly more false positives than MRI. While the sample size presented here is too small to draw conclusions on overall sensitivity and specificity of microUS, the results are promising for the use of microUS to identify PCa in accordance with previous work. Sample size will be increased in future work.

Figure 3: A – Example co-registration for one subject of MicroUS (red) and MRI (green) annotations to WM pathology (blue). Cross-sections of a lesion can be present in multiple WM slides. B – Percentage of identified index lesions, all lesions, lesion cross-sections and false positives annotations for MRI and microUS.
Introduction: Ureteral access sheaths (UAS) can improve procedural efficiency but also increase the risk of ureteral injury during ureteroscopic (URS) stone procedures. Our prior study revealed that injury can be prevented if the force of UAS passage is ≤ 6 Newtons (N). Accordingly, we sought to determine the force that urologists and residents-in-training use when placing a UAS.

Methods: Physicians with varying levels of urology training and experience were invited to participate at the 2022 American Urological Association and 2022 World Congress of Endourology meetings. The study involved passage of three UASs (12, 14, and 16 Fr) into a draped male genitourinary model containing a hidden force sensor. Participants were unaware that the exerted force was being recorded. Demographic data were collected via an online survey. A multivariable logistic regression was performed to identify characteristics associated with exceeding the 6N threshold.

Results: Among 121 participants, 45% (55 of 121) used UAS forces > 6N. The likelihood of exceeding 6N was directly related to years in practice (OR adjusted for years of practice: 0.651, 95% CI 0.431-0.984, p = 0.042). Physicians practicing at 1, 5, and ≥ 10 years had a 5%, 26% and 58% incidence respectively, of exceeding 6N. In contrast, the incidence of exceeding 6N was inversely proportional to the URS performed per month: 1-10, 11-20, and > 20 had a 65%, 42% and 28% incidence, respectively, of exceeding 6N (OR adjusted for ureteroscopies per month: 1.047, 95% CI 1.011-1.084, p = 0.026). Of note, 22.6% of the most experienced ureteroscopists exceeded 8N, the force at which urothelial splitting is common.

Conclusion: Overall, 45% of physicians surpassed the 6N threshold when inserting a UAS. The probability of exceeding 6N is negatively associated with the number of monthly ureteroscopies but positively associated with the years of experience in practice.

Table 1: Participant characteristics and relationship to force necessary for UAS insertion.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Group 1: Forces &gt;6N (n = 55)</th>
<th>Group 2: Forces ≤6N (n = 66)</th>
<th>p-value*</th>
<th>Group 3: Forces &gt;8N (n = 39)</th>
<th>Group 4: Forces ≤8N (n = 82)</th>
<th>p-value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Years of practice (mean; SD**)</td>
<td>13.5 (SD 13.7)</td>
<td>8.0 (SD 11.4)</td>
<td>0.008</td>
<td>14.18 (SD 12.15)</td>
<td>8.76 (SD 11.96)</td>
<td>0.014</td>
</tr>
<tr>
<td>Age (mean; SD)</td>
<td>45.7 (SD 12.4)</td>
<td>40.4 (SD 9.4)</td>
<td>0.023</td>
<td>46.74 (SD 13.49)</td>
<td>40.92 (SD 10.63)</td>
<td>0.018</td>
</tr>
<tr>
<td>Number of ureteroscopies (%)</td>
<td>0.026</td>
<td>0.154</td>
<td></td>
<td>0.920</td>
<td>0.382</td>
<td></td>
</tr>
<tr>
<td>0-10 per month</td>
<td>3 (33.3%)</td>
<td>6 (66.7%)</td>
<td></td>
<td>3 (33.3%)</td>
<td>6 (66.7%)</td>
<td></td>
</tr>
<tr>
<td>11-20 per month</td>
<td>17 (47.2%)</td>
<td>19 (52.8%)</td>
<td></td>
<td>9 (25.0%)</td>
<td>27 (75.0%)</td>
<td></td>
</tr>
<tr>
<td>&gt; 20 per month</td>
<td>8 (25.8%)</td>
<td>23 (74.2%)</td>
<td></td>
<td>7 (22.6%)</td>
<td>24 (77.4%)</td>
<td></td>
</tr>
<tr>
<td>Sex (%)</td>
<td>0.920</td>
<td>0.382</td>
<td></td>
<td>0.585</td>
<td>0.207</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>48 (45.3%)</td>
<td>58 (54.7%)</td>
<td></td>
<td>36 (34.0%)</td>
<td>70 (66.0%)</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>7 (46.7%)</td>
<td>8 (53.3%)</td>
<td></td>
<td>3 (20.0%)</td>
<td>12 (80.0%)</td>
<td></td>
</tr>
<tr>
<td>Employment (%)</td>
<td>0.585</td>
<td>0.207</td>
<td></td>
<td>0.117</td>
<td>0.541</td>
<td></td>
</tr>
<tr>
<td>Resident/fellow</td>
<td>10 (37.0%)</td>
<td>17 (63.0%)</td>
<td></td>
<td>5 (18.5%)</td>
<td>22 (81.5%)</td>
<td></td>
</tr>
<tr>
<td>Faculty</td>
<td>27 (49.1%)</td>
<td>28 (50.9%)</td>
<td></td>
<td>19 (34.5%)</td>
<td>36 (65.5%)</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>18 (46.2%)</td>
<td>21 (53.8%)</td>
<td></td>
<td>15 (41.7%)</td>
<td>21 (58.3%)</td>
<td></td>
</tr>
<tr>
<td>Fellowship (%)</td>
<td>0.117</td>
<td>0.541</td>
<td></td>
<td>0.682</td>
<td>0.874</td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>22 (56.4%)</td>
<td>17 (43.6%)</td>
<td></td>
<td>14 (35.9%)</td>
<td>25 (64.1%)</td>
<td></td>
</tr>
<tr>
<td>Endourology</td>
<td>17 (34.7%)</td>
<td>32 (65.3%)</td>
<td></td>
<td>13 (26.5%)</td>
<td>36 (73.5%)</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>16 (48.5%)</td>
<td>17 (51.5%)</td>
<td></td>
<td>12 (36.4%)</td>
<td>21 (63.6%)</td>
<td></td>
</tr>
<tr>
<td>Sheath Use (%)</td>
<td>0.682</td>
<td>0.874</td>
<td></td>
<td>0.748</td>
<td>0.874</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>39 (44.3%)</td>
<td>49 (55.7%)</td>
<td></td>
<td>28 (31.8%)</td>
<td>60 (68.2%)</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>16 (48.5%)</td>
<td>17 (51.5%)</td>
<td></td>
<td>11 (33.3%)</td>
<td>22 (66.7%)</td>
<td></td>
</tr>
</tbody>
</table>

*p-values were calculated using Pearson’s chi squared test except for the difference in mean years of practice and age (unpaired t-test) **SD = Standard deviation
ABSTRACT # 57

ASSESSING THE ROLE OF AUGMENTED REALITY TECHNOLOGIES IN UROLOGICAL SURGICAL MISSIONS

Kevin Kunitsky,1 Georgina Dominique,2,3 Gilles Natchagande,4 Michel Michaël Agounkpe,4 Fred D. Hodonou,4 Dodji Magloire Ines Yevi,4 Josué D. G. Avakoudjo,4 Mohamed Jalloh5, Abselom Lemma Gebreamlak6, Isiaka Lawal7, Charles Mabedi8 Kurt McCammon, MD,9 Graham Watson,10 Kymora B. Scotland, MD, PhD2

1Kansas City University of Medicine and Bioscience, Kansas City, MO; 2David Geffen School of Medicine at University of California, Los Angeles; 3Charles R. Drew University of Medicine and Science, Los Angeles, CA; 4Universitaire Centre National Hospitalier Universitaire Hubert K. Maga de Cotonou, Benin; 5Université Alioune Diop De Bambey, Senegal; 6Addis Ababa University, Ethiopia; 7National Hospital, Abuja Nigeria; 8Kamuzu Central Hospital, Lilongwe, Malawi; 9Eastern Virginia Medical School, Norfolk, VA; 10East Sussex Healthcare NHS Trust, East Sussex, United Kingdom

Introduction: During the COVID-19 pandemic, global surgery mission trips were halted, leading to the decreased opportunity for surgical skill sharing between surgeons from different countries. The development of augmented reality (AR) technology allows for the continuation of surgical training through virtual training and skill sharing even when travel is unavailable. We hypothesize that global urologic surgical training can be successfully undertaken through augmented reality.

Methods: To evaluate AR technology in global urologic surgical training, three urologic surgeons with subspecialization worked with four urologic surgeon trainees in Benin, Ethiopia, Nigeria, and Senegal using either the Proximie AR system or Vuzix AR smart glasses. Both systems are capable of audiovisual feedback to be transmitted in real time, thus allowing a trainer to guide a trainee during a procedure or with post operative care. Following procedures, both trainers and trainees answered a questionnaire regarding their experience using the AR systems.

Results: Fourteen surgical cases were performed using the AR technology with subsequent completion of questionnaires. Two separate technologies were evaluated. Trainees reported the AR technology as easy to set up and use in all cases, while trainers reported easy to set up and use in 72% of cases. Trainers reported acceptable visualization in 67% of cases and “looks like I’m there” in 33% of cases. Trainers also reported high impact of the ability to draw on the screen in 83% of cases and rated the ability to provide anatomical guidance as invaluable or significant in 94% of cases. Trainees also rated the audio impact and the ability to receive anatomical guidance as high and significant in 83% of cases. Trainers reported rarely having difficulty connecting with trainers in 91% of cases while trainers reported never or rarely having difficulty connecting with the trainee in 89% of cases. Trainers reported delay or time lag in 33% of cases, however, only reported the time lag as problematic in 11% of cases. Training did report a technical problem with equipment in 83% of cases.

Conclusion: Using AR technology allows for facilitation of surgical training between high income and lower-middle income countries. Both Vuzix and Proximie AR technologies offer audiovisual capabilities that allow for guidance during surgical cases and may facilitate transfer of surgical skills between trainers and trainees. Despite occasional virtual connection difficulties, AR technology may bridge the gap between trainer and trainee when in person surgical mission trips are limited or unavailable.

Figure 1: A) Proximie™ Augmented Reality System. Photo courtesy of Proximie™. B) Vuzix™ Augmented Reality Smart Glasses in use during surgery. Photo courtesy of Vuzix™.
SIZE MATTERS – WHICH IMAGING MODALITY BEST PREDICTS ACTUAL RESECTION WEIGHT IN ROBOT-ASSISTED SIMPLE PROSTATECTOMY?

Timothy K. O’Rourke, Jr.¹, Parth Thakker¹, Sumit Saini¹, Gregory B. Russell¹, Ram A. Pathak², Ashok K. Hemal¹
¹Wake Forest University School of Medicine / Atrium Health Wake Forest Baptist Medical Center, Winston-Salem, NC; ²Mayo Clinic Florida, Jacksonville, FL

Introduction: A key assessment in the surgical decision-making process for benign prostatic hyperplasia (BPH) is prostatic size. The American Urological Society Guidelines state that as part of the pre-operative workup, prostate size and shape should be assessed. Options for patients interested in surgical management with large (80-150 cc) and very large (>150 cc) prostates include laser enucleation and simple prostatectomy. We sought to better understand which imaging modality best predicts actual resected prostate weight in robot-assisted simple prostatectomy (RASP).

Methods: An IRB-approved retrospective review of all patients undergoing RASP at our institution from 2013-2022 was performed. 151 patients were identified with pre-operative imaging available for comparison to final pathology reported weight (grams). All patients had a pre-operative CT, MRI, trans-abdominal ultrasound (TAUS), or trans-rectal ultrasound (TRUS) before surgery. The mean difference for each modality from pre-operative imaging to reported weight on the pathology report was calculated and least square means was utilized to calculate differences between the relative predictive accuracy of each imaging modality. The prostate volume was calculated on cross-sectional imaging via the ellipsoid formula (L*W*H*π/6) if not otherwise specified in the radiology report.

Results: Of the 151 patients included, 49 (32.5%) underwent CT, 45 (29.8%) underwent TRUS, 35 (23.2%) underwent prostate MRI, and 22 (14.5%) underwent TAUS. The mean and median resected weight on final pathology were 102.8 (SD=55.8) and 93.0 with an IQR of 64.4-123.0. In a multivariable regression analysis, adjusting for age, method, and pre-operative size estimate, TRUS was found to be a more accurate predictor of final pathology weight relative to CT (p=0.0032, estimated deviation from final weight of 32.6 vs 55.1; pairwise difference 22.5, 95% CI (7.6, 37.3)). MRI was borderline more accurate than CT (p=0.052, MRI estimated deviation of 39.1; pairwise difference 16.0 (-0.1, 32.1)).

Conclusion: TRUS and MRI are the most accurate imaging modalities to predict prostate volume in relation to resection weight on final pathology. TRUS does not well-delineate the prostatic zonal anatomy relative to MRI. MRI has the relative advantage of improved detection of lesions suspicious for clinically significant prostate cancer. In patients considering surgical BPH management, these findings justify considering a dedicated MRI and/or TRUS to best characterize prostate size and shape ahead of RASP.
ABSTRACTS

ENHANCED ASSESSMENT OF URODYNAMICS IN A PATIENT-SPECIFIC, IN VITRO MODEL OF THE BLADDER USING DYNAMIC 3D MRI AND PARTICLE IMAGE VELOCIMETRY

James Rice1,2, Jack Gwertzman1, Alejandro Roldán-Alzate1,2

1 Department of Mechanical Engineering, University of Wisconsin-Madison; 2 Department of Radiology, University of Wisconsin-Madison

Introduction: Lower urinary tract symptoms (LUTS) and changes in bladder function occur as individuals age [1]. Patients with LUTS are evaluated through multi-channel urodynamic studies to determine bladder flow and pressure during voiding and filling [2]. However, these tests are invasive and provide limited flow visualization and quantification [3]. The aim of this study was to develop an MRI- and PIV-compatible patient-specific, in vitro model of the bladder to validate a real-time volumetric MRI protocol and quantify 2D velocities and pressures inside the bladder during a simulated voiding event.

Methods: In this IRB-approved, HIPPA compliant study, a flexible, transparent, in-vitro model of the bladder was constructed using a hybrid additive manufacturing process. The model was connected to a syringe pump where refractive index matching fluid was withdrawn from the system at different flow rates to simulate voiding in a controlled manner. The bladder was placed in a 3.0T MRI scanner where dynamic 3D, and 2D-phase contrast (2D-PC), MRI data were acquired. An MRI-compatible, fiber-optic pressure transducer (OPP-M200, Opsens Inc., Québec, CA) was fed into the bladder during MRI acquisitions to obtain real-time pressure measurements. For particle image velocimetry (PIV) experiments, the fluid was seeded with PMMA particles and data were acquired using a Flowmaster system (LaVision, Germany), consisting of a dual-pulse 527 nm Nd:YLF laser opposite a high-speed camera.

Results: The model creation pipeline is outlined in Figure 1A. Dynamic MRI volumes were successfully acquired during simulated voiding events and used to compute flow rate (Figure 1B). MRI-derived flow rate differed from prescribed flow rate by 4.90% on average. Figure 1C depicts velocity contours at the center of the model obtained with PIV for the fastest voiding event. Pressure curves and volume flow rate comparisons for all three events are shown in Figure 1D. A pressure drop is seen during voiding that is insensitive to flow rate. Velocity distributions obtained from PIV in the bladder show a region of slow flow near the top of the bladder which accelerates toward the bladder outlet. Peak outlet velocities derived from PIV and 2D-PC MRI exhibited good agreement (Figure 1E).

Conclusion: This modeling pipeline represents a novel technique to systematically assess the validity of experimental MRI in the bladder. 3D volumes from MRI were successfully used to compute volumetric flow rate during voiding events. PIV successfully captured time-resolved velocity distributions inside the bladder model that could be compared to 2D-PC MRI. Finally, pressure could be simultaneously quantified during each voiding event.

Figure 1: (A) In-vitro model construction pipeline. (B) Time-resolved 3D volumes obtained from dynamic MRI for 5.37 cc/s voiding event. (C) Time-resolved velocities obtained from PIV for voiding event in (C). (D) Pressure, volume, and flowrate measurements acquired for three voiding events (5.37, 2.50, 0.833 cc/s). (E) Velocity at bladder outlet cross-section obtained from 2D-PC MRI.
ABSTRACTS

ABSTRACT # 60

NOVEL NANOPARTICLE COATINGS WITH ANTIBACTERIAL AND ANTIBIOFILM PROPERTIES

Juan Sebastian Rodriguez-Alvarez MD\textsuperscript{1}, Yue Xu MSc\textsuperscript{2}, Jorge Gutierrez-Aceves MD\textsuperscript{1},
Smita De MD PhD\textsuperscript{1}, Aaron Miller PhD, Vijay Krishna PhD\textsuperscript{1}
\textsuperscript{1}Cleveland Clinic Glickman Urological and Kidney Institute, Cleveland, OH, USA;
\textsuperscript{2}Cleveland Clinic Lerner Research Institute, Cleveland, OH, USA

Introduction: Device-associated infections account for over 25% of all hospital acquired infections \cite{1}. Of these, catheter-associated urinary tract infections (CAUTI) are considered the most common hospital-acquired infections, and \textit{Escherichia Coli} is one of the most commonly isolated bacteria. \cite{2, 3} Biofilms on devices such as urethral catheters and ureteral stents are associated with infections that result in antimicrobial and immune resistance; ultimately requiring device exchange or removal. \cite{2, 4} Silver coatings have been used due to its antibacterial properties. Further literature suggests that composite gold and silver nanoparticles have superior antimicrobial activity. \cite{5, 6} In this study, we engineered novel antimicrobial nanoparticles (NP) composed of silver and gold NPs using polyhydroxy-fullerenes (PHF) as a single reducing and stabilizing agent. PHF has been shown to enhance formation of reactive oxygen species (ROS) and could further enhance antimicrobial activity. \cite{7} The engineered metal NPs were evaluated for antimicrobial and anti-biofilm formation properties.

Methods: PHF was used for synthesizing gold (AuNP), silver (AgNP), gold-silver bimetallic (AuAgNP) and silver-platinum bimetallic (AgPtNP) NPs. These NPs were then coated on polyurethane discs. To induce biofilm formation, coated and uncoated discs were incubated overnight in broth containing \textit{E. coli}. The broth was sampled and serially diluted to evaluate bactericidal properties of the NP coatings on \textit{E. coli}. Biofilms were detached from the discs into phosphate-buffered saline and serially diluted. All dilutions were plated and incubated for quantification of colony forming units (CFU) and CFU/mL. Experiments were done in triplicate.

Results: AgNP showed a bactericidal effect with a mean 3.2-log reduction of \textit{E. coli} CFUs compared to uncoated controls (p<0.001). AuNP did not show any significant antibacterial nor anti-biofilm activity. Antibacterial activity of AgPtNP was similar to AgNP. In contrast, a significant bactericidal effect was observed with AuAgNP with a mean 5-log reduction. To investigate this further, we tested a 1:1 mixture of AuNP and AgNP, which showed a mean 8.5-log reduction showing a strong synergetic effect between gold and silver. The anti-biofilm and antibacterial properties were similar across NPs (Figure 1).

Conclusion: Engineered AuNP+AgNP have superior antibacterial and antibiofilm properties and could potentially reduce implant colonization and associated infections.

**Figure 1:** Schematic representation of an AuNP and a detail of one PHF molecule (top). Anti-biofilm (bottom left) and anti-bacterial (bottom right) activity of different nanoparticles on polyurethane discs. ****: p<0.0001; **: p<0.01; *: p<0.05; ns: non-significant (p>0.05).
DEVELOPING A MECHANICAL ANTIBIOTIC ALTERNATIVE TO PREVENT URINARY TRACT INFECTION

Maya Overland, MD PhD¹, Deepak Patil, PhD², Moyeez Alam, BE², Kaushik Chatterjee, PhD², Marshall Stoller, MD³
¹ Division of Urology, Children’s Hospital of Philadelphia, University of Pennsylvania, Philadelphia PA; ²Department of Urology, University of California, San Francisco CA; ³Department of Materials Engineering, Indian Institute of Science, Bengaluru, India

Introduction: Urinary tract infections (UTIs) place a huge burden on patients and the global healthcare system. There are over 400 million diagnosed UTIs each year, disproportionately affecting low- and middle-income countries. Antibiotic prophylaxis and treatment are the current mainstay of recurrent UTI management in both the pediatric and adult populations. Antibiotics are easily accessible and effective when appropriately targeted, however, growing antibiotic resistance patterns related to overuse in humans and in livestock are an increasing threat to public health and food security. Prior studies have demonstrated: (1) the ability of complex machined multilayer microscale traps to clear motile bacteria in silico and in vitro [PMC5381207]; and (2) the bactericidal and anti-biofilm properties of biomimetic nanoscale etching [PMC5788004]. A mechanical approach to UTI prophylaxis contingent upon the sequestration and localized killing rather than the systemic poisoning of pathogenic bacteria would minimize the risk of serious systemic side effects, eliminate difficult to adhere to daily or weekly treatments, and has the potential for widespread adoption across diverse patient populations.

Methods: Using a salt-leaching approach, we generated porous scaffolds from biocompatible polymers with a variety of targeted pore sizes and we added micro/nanoscale surface texturing using reactive ion etching. In addition, scaffolds were doped with silver and copper nanoparticles to add further bactericidal activity. Efficacy of the scaffolds to clear a variety of motile and non-motile strains of bacteria was tested in vitro in a simple agitated broth culture model.

Results: Porous scaffolds cleared over 40% of motile E. coli, over 50% of biofilm-forming P. aeruginosa, and nearly 30% of biofilm-forming S. aureus from bacterial culture solutions over a 10-hour period. The effects were sustainable over several days with a persistent >40% reduction of E. coli in solution at 48 hours as compared to no-scaffold control cultures. Both etching and silver or copper doping had additive dose-dependent effects on the efficacy of the porous scaffolds, with a nearly 60% reduction of E. coli in solution with etching of both the top and bottom surfaces of the scaffolds (see figure), and with a >90% reduction in all three organisms at doping concentrations of silver and copper that resulted in a <1ppm concentration of leached metal ions into static buffered solutions at steady state.

Conclusion: This proof-of-principle demonstration of a simple, scalable approach to bacterial trapping in solution is a promising novel approach to UTI prophylaxis. In next steps we are testing and optimizing the efficacy of these scaffolds to clear a variety of uropathogenic bacteria in a rodent model of UTI.
PROSTATE VOXEL MODEL RECONSTRUCTION FROM TRACKED MICRO-ULTRASOUND IMAGES

Alejo Ballester¹, Wayne Brisbane, MD², David Lizdas, BS¹, Chris Samouce, PhD¹, Yahya Acar, MD¹, Samsun Lampotang, PhD, FSSH, FAIMBE¹,³
¹University of Florida, Center for Safety, Simulation & Advanced Learning Technologies; ²University of California, Los Angeles, Department of Urology; ³University of Florida, Department of Urology

Introduction: Our aim is to extend an existing prostate biopsy (PBx) simulator [PMID: 33961325] to simulate micro-ultrasound (micro-US) imaging. Using images from consenting patients acquired via a micro-US probe tracked in six degrees of freedom (6DOF, x, y, z, yaw, pitch, roll), we implemented a 3D voxel model to reconstruct virtual prostates that can generate micro-US images for all possible 6DOF positions of a tracked simulated micro-US probe, including positions not part of the original patient scans.

Methods: Images were captured from an ExactVu 29MHz micro-US system (0.07 mm resolution) at ~50 fps to a computer (64 GB RAM, Intel Core i9-9920X CPU, 12 cores, 24 threads). The probe (EV29L) was tracked with an electromagnetic (EM) sensor (Model 800, NDI). Tracking and imaging data were collected simultaneously during two 180° clockwise probe rotations (sweeps) covering the base/mid-gland, then mid-gland/apex regions. Each sweep lasted 90 seconds with ~3 minutes of saving time after each sweep. Approximately 10,000 images were captured for each of 6 patients (~5,000/sweep). After cropping images to the desired regions and transforming coordinate systems, each sweep was compiled into an image sequence file (.mha) with custom, application-specific headers. The image sequence files were then used as input for the PLUS Volume Reconstructor utility [PMID: 24833412]. The utility creates a voxel grid with a coordinate system and fills voxels with the average of the pixel values located within the individual voxel volume (i.e., mean compounding mode). A hole-filling and interpolation algorithm then assigns values to empty intermediate voxels, completing the reconstruction. The resulting file was a 3D .mha image, which was visualized and inspected in 3D Slicer. Manual and automated registration of the sweeps and segmentation were performed to extract a complete voxel model and mesh of the prostate that were then integrated into the PBx simulator.

Results: The reconstructed models were sensitive to artifacts (EM interference, EM sensor misalignment) that affected 6DOF probe tracking. Some portions of the reconstructed 3D prostate could be used in the absence of artifacts in a PBx simulator. Figure 1 to the right shows a reconstructed sweep with displacement of the rotation axis and possible EM interference. Additional testing suggested the artifacts can be attributed to the tracking and data acquisition systems.

Conclusion: A reconstruction and integration protocol for the reconstructed prostate was successfully developed. The quality of the reconstruction is contingent on collection of data free of artifacts. We are working to quantify and mitigate the impact of EM interference and EM sensor misalignment and instability during the sweep of patient prostates.
ABSTRACTS

ABSTRACT # 63

AN ANATOMY-BASED VAGINAL DILATOR AND HOME INSEMINATION DEVICE FOR CIS AND TRANSGENDER PEOPLE

Sandhu, SS.1,2, Mallavarapu, S.1,2, and Garcia, MM.1,2

1 Department of Urology, Cedars-Sinai Medical Center, Los Angeles; 2 Transgender Surgery and Health Program, Cedars-Sinai Medical Center, Los Angeles

Introduction: Gender affirming genital surgery is a rapidly growing and evolving field. The majority of (though not all) transfeminine patients seeking vaginoplasty surgery request creation of a vaginal canal. A neovaginal canal must be dilated and douched, to prevent stenosis and to maintain hygiene. Unfortunately, because a neovagina is lined by penile and scrotal skin, it is not nearly as elastic as a cis-gender woman’s vaginal canal. Consequently, a neovagina is more sensitive to dilator shape, and douche-nozzle length (so that douche water reaches the vaginal vault, where chronic inflammation from limited hygiene can cause granulation tissue. Vaginal dilators commercially available to trans patients are designed for cis, not trans gender women, and all are either straight, or, have an abrupt upward curve at the tip, yielding an overall shape that is not consistent with pelvic anatomy. We assessed vaginal canal shape in trans women post-vaginoplasty, and, vaginal canal shape in cis-gender women based on the literature, and sought to: 1. Design a vaginal dilator that reflects pelvic and canal anatomy; 2. Create a novel dilator that combines dilation, douching, and depth measurement functions; 3. Modify our new dilator-douche device for use with semen, for home insemination by cis and trans women, and, trans men.

Methods: We imaged and measured the angle of the neovaginal canal from introitus to vault in 12 trans women using a floppy radio-opaque catheter and C-Arm fluoroscopy. We consulted gynecologic texts and reviewed the design of current and historical surgical instruments, to ascertain the shape of the vaginal canal in cis-gender women, and the distance of the cervix from the vaginal vault. We designed a novel dilator using ink-drawings and then later CAD-files to produce 3D printed prototypes, which we then modified iteratively. A sex-toy company made our initial prototypes for us.

Results: We found that the natural shape of the trajectory of the vaginal canal in both cis and trans women is a smooth “S-shape”, which, not surprisingly is the shape of both modern cervical dilators, and in surgical texts dating back 300 years. In ciswomen the vaginal vault of their highly elastic canal is located much closer to the introitus than in trans women, whose canal is inelastic and fixed. The cervix is typically located on the anterior surface of the canal, and, located between 0.5 to 4 cm proximal to the posterior fornix. The vaginal dilator we created Figure 1a-c, red asterisk) reflects the smooth S-shaped curve we found, and, to avoid suction, has number markings to measure depth, and side-wall grooves to allow air and liquid to pass insertion and withdrawal. The dilator is hollow and can be fitted with a douche-bulb (Figure 1b, blue). The dilator (only) has a hole at the tip, and sides near the tip.

Our insemination device (Figure 1a-d) is similar, but shorter, accommodates a 10 cc syringe (for introduction of semen), and has a recessed area on the anterior wall, 0.5-4 cm from the tip, for up to 6 cc of semen to pool and bathe the cervix with semen.

Conclusion: We believe that the design improvements with make dilation more comfortable for women, and, for trans women who must douche, improve hygiene and decrease the incidence of granulation tissue. Our inseminator offers a private, at-home means of achieving fertilization at home for cis-gender and transgender women. U.S. Patent claims have been issued for all designs shown.
ROBOTIC FLEXIBLE URETEROSCOPY SYSTEM, ZAMENIX: EFFICACY AND SAFETY VALIDATION THROUGH CLINICAL TRIAL

Joonhwan Kim¹, Jungmin Han¹², Byungsik Cheon¹², Dong-Soo Kwon¹², Joo Yong Lee³, Sung Yong Cho⁴

¹ROEN Surgical Inc., Daejeon, Korea; ²Korea Advanced Institute of Science and Technology, Daejeon, Korea
³Department of Urology, Severance Hospital, Urological Science Institute, Yonsei University College of Medicine, Seoul, Korea
⁴Department of Urology, Seoul National University Hospital, Seoul National University College of Medicine, Seoul, Korea

Introduction: Retrograde intrarenal surgery using a flexible ureteroscopy is gaining popularity for minimally invasive renal stone treatment. The authors have developed the robotic flexible ureteroscopy system, Zamenix. In the previous work, the feasibility and safety of robotic RIRS using Zamenix were validated from the porcine model study[1][2]. Reduction of surgeon discomfort and radiation exposure was demonstrated as well. This study aims to evaluate the efficacy and safety of robotic RIRS through a clinical trial.

Methods: The Zamenix is a master-slave robot system capable of telesoperation of an ureteroscope, a laser fiber, and a stone basket. The system features semi-automatic navigation and stone size estimation functions to improve efficiency and safety during the stone removal. Total forty-six Korean adult patients who have one or more stones with a maximum size of 5 – 30 mm were treated with Zamenix[3]. The primary outcome is stone-free rate which is defined as no visible stone or residual stones less than 4 mm (<4 mm) inspected by one-month postoperative CT scan. The secondary outcomes include such as operation time, ureteral injury, and postoperative complication. Two expert urologists from two institutes participated in the study and performed 23 cases of robotic RIRS each.

Results: The stone-free rate was 93.5%(43/46). The surgeon could achieve a stone-free status in all cases after the 12 trials. The operation time and the console time were 95.1±39.1 and 72.2±38.1 minutes, respectively. Three cases of Grade I ureteral injury and five cases of Grade II ureteral injury were observed, which were all related with ureteral access sheath insertion before the application of the robotic procedure. Three cases of Grade II(Clavien-Dindo Classification) postoperative complications(urinary tract infection) were observed during the one-month follow-up period. All patients were treated with medication and recovered well. The surgeons experienced several advantages which may affect the procedural efficiency and safety: Less fatigue even after a series of surgeries, stable and precise laser aiming under the patient respiratory motion.

Conclusion: The result demonstrated a high stone-free rate and low risk of complication, which suggested the potential efficacy and safety of robotic RIRS using Zamenix. Further study will be conducted with more patient cases and different surgeon proficiency to explore the clinical benefits. Zamenix obtained approval of the Korea Ministry of Food and Drug Safety in Oct. 2022, and currently is preparing for FDA clearance.
APPLICATION OF 3-DIMENSIONAL (3D) PRINTING TO PROTOTYPING A SURGICAL DEVICE: ENSURING RAPID PROGRESSION FROM CONCEPT TO CLOSURE

Matthew Polson¹, Jonathan Shiba¹, Juan Ramirez¹, Peyton Tebon², Steven Popoli², Renea Sturm¹, George Aninwene II¹
¹Department of Urology and ²Department of Bioengineering, University of California, Los Angeles

Introduction: Effective and efficient internal tissue closure techniques for use in a rapidly changing minimally invasive surgical landscape are needed. In complex lower urinary tract reconstruction, additional support at the suture line can reduce the technical challenges that result in the 30-68% chance of post-operative complications and decrease the total operative time for robotic procedures [PMC 17706712, 4992015, 5798533, 16830152].

Study aims: 1) Establish an iterative workflow to rapidly provide end-user feedback to engineers designing a surgical closure device prototype, 2) Apply feedback to modify 3D printed models to minimize mechanical failure points while ensuring efficient operative time for laparoscopic closure.

Methods: Models of internal closure devices for planned application across a suture line were created in Autodesk Inventor and manufactured with a Form3 3D printer using Elastic 50A flexible resin (Fig a-c). An Instron 345C-1 tensile tester was used to determine tensile strength at failure (ultimate tensile strength (UTS) in kPa) for each closure system (10mm/min, 27°C, ISO ASTM 2458, n=4 to 7/cohort). For each prototype, a surgeon conducted timed closure tests with 10 replicates per prototype using a laparoscopic trainer (Laparoscopyboxx, 5mm instruments) and recommended modifications to improve closure time and handling. Each model was then digitally modified, new models were 3D printed, and subsequent testing ensued until engineering design criteria were achieved. Successful device design criteria: 1) UTS that met or exceeded that of current standard tissue repair (2-layer running suture, porcine bladder: 243.5±8.1kPa) and 2) Maximum 3 to 5 minutes to close device. Results were reported as mean ± standard error (SEM). Unpaired student t-tests determined significance between experimental cohorts; p≤0.05 was defined as significance.

Results: The initial design concept (Patent #US20220361876A1) was a two-piece closure system that pulls tissue together across an incision. Through iterative prototype evaluation, >28 individual models were developed and evaluated; 4 representative results are provided (Fig c,d). Models were initially informed by existing external devices; iterative modifications eliminated sites of early device failure. For example, the Latch-Larrel model reinforced the latch and clasp while securing the latch, thereby resulting in a 142.6% mean increase in UTS versus Latch v3 and 137.4% versus sutured tissue. Models were likewise optimized for laparoscopic surgical application. By combining key features, the Latch-Larrel model had the greatest UTS (577.9±16.9kPa) while maintaining time to closure of the Barrel or Larrel alone (171.5s ±17.0s).

Conclusion: The proposed workflow facilitated rapid generation of novel testable closure devices based on surgeon feedback in less than 24 hours per iteration. The Latch-Larrel model achieved engineering design criteria and will progress to further surgeon and tensile testing using candidate materials for internal suture line reinforcement in minimally invasive procedures. The workflow developed in this study provides a readily applicable framework for surgical device optimization in multi-disciplinary teams with a compressed timeframe; in future studies it can be combined with computational modeling to further minimize failure points and facilitate rapid prototyping across devices.
DEPENDENT LOOPS FOIL CHEST-TUBES AS THEY DO URINARY CATHETERS, BUT IN REVERSE! A SOLUTION FOR EARTH AND SPACE

Bullock, TJ.¹, Sandhu, SS², Hill, A.³, Fuller, C.⁴, and Garcia, MM⁵,⁶

¹ School of Medicine, University of California San Francisco; ² Department of Urology, Transgender Surgery and Health Program, Cedars-Sinai Medical Center, Los Angeles; ³ Division of Cardiothoracic Surgery, University of California San Francisco; ⁴ Division of Thoracic Surgery, Cedars-Sinai Medical Center, Los Angeles

Introduction: Urologists use thoracostomy drainage collection systems regularly. Similar to what we have shown occurs in urinary catheters (Garcia, Stoller et al, 2017), pleural fluid pools at the bottom of dependent loops of both thoracostomy drainage tubing systems. We hypothesized: (1) Most urologic and thoracic surgeons do not appreciate the effect of dependent loops on thoracostomy drainage; and (2) Fluid pooled in a dependent loop diminishes the expected negative pressure-head delivered to the pleural space by a chest-tube and obstructs antegrade drainage. We sought to test our hypotheses.

Methods: We created an anonymous questionnaire for 6 urologists and 4 thoracic surgeons at our institution, showing pictures of Pleur-Evac drainage kits set to -20 cmH₂O wall suction, exactly as regularly seen at bedside, each filled with variable degrees of fluid, and asked respondents to state what negative pressure head they expected existed at the chest-tube end (Figure 1a). We then created an ex-vivo thoracostomy-tube model to measure the negative pressure at the chest-tube end when the drainage tube had a dependent loop of various lengths and was filled with increasing amounts of fluid in 5 ml increments (Figure 1b, c). Lastly, we and performed a human clinical trial: Pressure within the drainage tube, and loop-height, were measured in six ICU patients with thoracostomy tubes in place following CABG surgery. Fitted linear regression of pressure and loop-height was performed.

Results: The questionnaire found that all 10 respondents answered that the negative pressure at the chest tube would be -20 cmH₂O regardless of fluid in the dependent loop. Our model and human trials showed that with an empty dependent loop, thoracostomy tube pressure equaled the suction pressure (-20cm H₂O), but when fluid pooled in the dependent loop chest-tube negative pressure diminished (p < 0.0001) in a loop-height dependent fashion: in real patients, +1 cm loop-height made the chest-tube pressure more positive (i.e. less negative) by +0.086 cm H₂O.

Conclusion: Thoracostomy-tube negative-pressure is steadily diminished as a dependent loop fills with fluid. The resulting air-lock opposes antegrade drainage. The weight of the fluid column accounts for positive thoracic pressures, which could account for why many patients fail water seal trials. We have developed a proposed solution to eliminate airlocks, which utilizes an Archimedes screw (Figure 2: Gravity independent medical drainage system; US Patent #: 11376151). Development of a scalable, working prototype is warranted, as a solution to this problem would have broad application throughout medicine, and even for use in space (e.g., catheters, space toilets, plumbing, sewage), where fluid drainage is, by nature, gravity independent.
ABSTRACTS

ABSTRACT # 67

SHORTCOMINGS IN URINARY CATHETERIZATION TRAINING AND DEVELOPMENT OF A NEW GENERATION OF PHYSICAL TASK TRAINERS

Michaela Mullison¹, Sonakshi Raju¹, Gregory Zdanowski-House¹, Michael J. Young, MD², FACS, Michael G. Browne, PhD³
¹College of Medicine, University of Illinois Chicago; ²Department of Urology, University of Illinois Chicago; ³Department of Biomedical Engineering, University of Illinois Chicago

Introduction: Foley catheterization is a foundational procedure throughout healthcare. When done correctly, it allows for hydration management and relieves AUR (Acute Urinary Retention). When done incorrectly, the effects can be disastrous. Iatrogenic urethral injuries and improper urethral catheterization has been reported in 0.3-3% of catheterization attempts [PMC4401990]. With approximately 25% of patients having a urethral catheter placed during their in-patient hospital stay [Chenoweth, C., & Saint, S. (2013)], the overall number of complications stemming from improper catheterizations is unacceptable. To ensure effective catheterization, good training is a necessity. Medical trainees frequently rely on physical task trainers to practice procedural skills like urethral catheterization. Our project seeks to redesign one of the leading foley catheterization trainers to improve skill acquisition and patient outcomes.

Methods: Methods included stakeholder interviews, training observation, first-hand experiences, and literature review. Stakeholders interviewed in this phase of the project included SAIL (Simulation and Integrative Learning Institute) training and administration staff, medical students attending the University of Illinois Chicago College of Medicine with different levels of experience with catheterization, as well as other healthcare professionals.

Results: We identified numerous shortcomings in commercially available training models. The current trainer used at SAIL has concerns of unrealistic anatomy, lack of negative feedback, insufficient positive feedback, and low durability. The external shape of the device combined with the lack of adjustable extremities leads to reinforcement of improper catheterization techniques, risking contamination of the sterile field. This increases the risk of CAUTIs (Catheter-Associated Urinary Tract Infections) and patient trauma [PMC4114799]. Additionally, the fixed angle between the legs is not representative of the varying degrees of hip mobility found in a diverse patient population. The trainer’s internal design flaws promote leaks, preventing model usage with simulated urine, a key positive feedback signal. In addition, the urethral passage of the current trainer lacks realistic complexity, forfeiting simulation of the prostate and common strictures, crucial for male catheterization. The current model does not provide users with negative feedback when serious mistakes are made, such as inflation of the catheter’s balloon in the urethra [Subramanian, V., Soni, B.M., Hughes, P.L. et al. (2016)].

Conclusion: The number of shortcomings in the current trainer warrants a complete redesign. We came to this conclusion based on our stakeholder interviews, training observation, hands-on experience, and assessment of current trainers on the market as well as evaluation of new, alternative trainers [PMC7328704, PMC6977004]. Little innovation has been attempted in this area, leaving learners with extremely simple, anatomically inaccurate models to train with. Our improved model, currently undergoing development, aims to fix those problems. We intend to redesign the foley catheter trainer to mimic external human anatomy, internal pelvic anatomy, and include both positive and negative feedback. The new generation of trainers will provide improved skill acquisition and better patient outcomes, while achieving an ROI (Return on Investment) at equivalent or better levels as compared to currently available solutions.
ABSTRACTS

ABSTRACT # 68

ALTERNATIVES TO THE HALF-HITCH FOR THE FIRST THROW IN SURGICAL KNOT TYING

Steven M Monda, Hansen T Lui
Department of Urologic Surgery, University of California Davis

Introduction: The standard reference for knots across many professions remains The Ashley Book of Knots (ABOK) published in 1944. This book describes thousands of knots in an era where knots were still commonplace in many industries. We examined the utility of a subset of binder knots—where after an initial knot, alternating half-hitches are stacked to secure the knot in a way familiar to modern surgeons.

Methods: ABOK 183 and ABOK 187 were selected for their ability to be tied in an efficient one-handed or two-handed fashion respectively. See hyperlinks within text for video. Both were secured with alternating half-hitches after the initial knot. In each, a “noose” is formed around the post-arm of the knot (the inferior strand in Figs.1b & 1c) and traction of this post-arm snugs the knot downward to the tissue. Half-hitches are thrown to secure the knot. We compared ABOK 183 and 187 to starting with a half-hitch in time to completion and knot security.

Results: Mean time for a knot followed by four half hitches was 15.7 seconds (95% CI, 14.5-16.9), 17.4 seconds (95% CI, 15.3-19.5), and 25.9 seconds (95% CI, 23.9-27.9) for a standard half-hitch, ABOK 183, and ABOK 187 respectively. In all tested knots, a knot followed by four half-hitches in monofilament was sufficient to ensure knot slippage would not occur and suture would instead fail via breakage.

Conclusion: Alternative initial knots to the half-hitch may have utility when exact tension or increased tension is needed on the tissue being closed. The perceived advantage of the described binding knots (ABOK 183 & ABOK 187) is that tension on the post tightens the knot on the tissue with minimal chance of the knot squaring early and causing an air knot.

Figure 1a. Starting half-hitch: this can be thrown in same direction to achieve a granny knot that will more readily slide.

Figure 1b. ABOK 183

Figure 1c. ABOK 187

Figures 1a-c. The left most knot in each figure represents the initial knot to which half hitches can be added.
SOCIETY OFFICERS:

PRESIDENT
Joseph C. Liao

SECRETARY
Margaret Pearle

TREASURER
Chandru Sundaram

COUNCILOR
Louis Kavoussi

EXECUTIVE DIRECTOR
Dan Stoianovici

ADVISORY BOARD
Jeffrey Cadeddu
Ralph Clayman
Jean de la Rosette
Misop Han
Pilar Laguna
Thomas Lawson
Manoj Monga
Pierre Mozer
Stephen Nakada
Jens Rassweiler
Koon Ho Rha
William Roberts
Arthur Smith
Li-Ming Su
Gerald Timm
Hessel Wijkstra
Kevin Zorn
AWARDS:

BEST ABSTRACT AWARDS:

A METHOD FOR NAVIGATION DURING ENDOSCOPIC KIDNEY SURGERY; Ayberk Acar¹, Daiwei Lu¹, Yifan Wu¹, Ipek Oguz¹, Nicholas Kavoussi², Jie Ying Wu¹; ¹Dept. of Computer Science, Vanderbilt University ²Dept. of Urology, Vanderbilt University Medical Center

MAGNETIC RETRIEVAL OF STONE FRAGMENTS: DESIGN, PROTOTYPING AND HEAD-TO-HEAD COMPARISON WITH STONE RETRIEVAL BASKET; Daniel Massana Roquero¹,², T. Jessie Ge¹,² Zachary Kornberg¹,², Grace H. Holton¹,², Kathleen E. Mach¹,² Shan X. Wang³, Joseph C. Liao¹,²; ¹Department of Urology, Stanford University, Stanford, USA; ²VA Palo Alto Health Care System, Palo Alto, USA; ³Department of Materials Science and Engineering, Stanford University

ENHANCED ASSESSMENT OF URODYNAMICS IN A PATIENT-SPECIFIC, IN VITRO MODEL OF THE BLADDER USING DYNAMIC 3D MRI AND PARTICLE IMAGE VELOCIMETRY; James Rice¹,², Jack Gwertzman¹, Alejandro Roldán-Alzate¹,²; ¹Department of Mechanical Engineering, University of Wisconsin-Madison; ²Department of Radiology, University of Wisconsin-Madison
TOP 10 ABSTRACTS:

SIMULATION OF ENERGY ABSORPTION DURING LOW INTENSITY SHOCKWAVE THERAPY IN THE FLACCID AND ERECT PENIS; Irwin Goldstein, MD1, Alyssa Yee, MD1, Erich Theuer PhD2, Nikolaus Hopfenitz LL.M3, John Warlick4; 1 San Diego Sexual Medicine, 2Medical Simulation Engineering, 3MTS Medical, 4Softwave TRT

ACHIEVING A BLADDER ACELLULAR MATRIX WITH PRESERVED ARCHITECTURE AND MECHANICS OF THE HEALTHY NATIVE BLADDER; Victoria Lee1, Felix Yiu1, George Aninwene II1, Astha Sahoo1, Jonathan Shiba1, Nohemi Garcia-Soto1, Vijaya Pandey2, James Wohlschlegel2, Renea Sturm1; 1UCLA Department of Urology; 2UCLA Proteome Research Center

VARIATION IN AUS PRESSURE REGULATING BALLOONS AND CUFF FOLLOWING EXPLANATION; Shree Agrawal-Patel MD1, Kevin Lewis MD1, Mohamad Elazab BS2, Madison Lyon MD1, Tara Nagle MS2, Jeremy Loss MS2, Bradley Gill MD1, Kenneth Angermeier MD1, Steve Majerus PhD4, Margot Damaser PhD1,2,3; 1 Cleveland Clinic, Glickman Urological and Kidney Institute, Department of Urology; 2 Cleveland Clinic, Lerner Research Institute, Department of Biomedical Engineering; 3Louis Stokes Cleveland Veterans Affairs Medical Center, Advanced Platform Technology Center, 4Case Western Reserve University, Department of Electrical, Computer and Systems Engineering

IN-VIVO THERMAL TISSUE MAPPING IN A PORCINE MODEL DURING LASER ACTIVATION; Ron Marom1, Julie J. Dau1, Timothy L. Half1, Khurshid R. Ghani1, William W. Roberts1,2; 1 Department of Urology, University of Michigan, Ann Arbor, MI, USA, 2Department of Biomedical Engineering, University of Michigan, Ann Arbor, MI, USA

EXTRACAPSULAR EXTENSION RIS ASSESSMENT USING AN ARTIFICIAL INTELLIGENCE PROSTATE CANCER MAPPING ALGORITHM; Alan Priester1,2, Sakina M. Mota2, Joshua Shubert2, Shyam Natarajan1,2, Wayne G. Brisbane1; 1 University of California, Los Angeles; 2Avenda Health, Inc.

ASSIST-U: A SYSTEM FOR SEGMENTATION AND IMAGE STYLE TRANSFER FOR URETEROSCOPY Daiwei Lu1, Yifan Wu1, Ayberk Acar1, Xing Yao1, Jie Ying Wu1, Nicholas Kavoussi2, Ipek Oguz1; 1 Dept. of Computer Science, Vanderbilt University.; 2 Dept. of Urology, Vanderbilt University Medical Center, Nashville, TN

NOVEL NANOPARTICLE COATINGS WITH ANTIBACTERIAL AND ANTIBIOFILM PROPERTIES; Juan Sebastian Rodriguez-Alvarez MD1, Yue Xu MSC2, Jorge Gutierrez-Aceves MD1, Smita De MD PhD1, Aaron Miller PhD, Vijay Krishna PhD1; 1 Cleveland Clinic Glickman Urological and Kidney Institute, Cleveland, OH, USA; 2 Cleveland Clinic Lerner Research Institute, Cleveland, OH, USA
### BEST REVIEWER AWARDS (LAST 5 YEARS):

<table>
<thead>
<tr>
<th></th>
<th>2018</th>
<th>2019</th>
<th>2021</th>
<th>2022</th>
<th>2023</th>
</tr>
</thead>
<tbody>
<tr>
<td>George</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>☀</td>
</tr>
<tr>
<td>Tareq</td>
<td>☀</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jeffrey</td>
<td></td>
<td></td>
<td></td>
<td>☀</td>
<td></td>
</tr>
<tr>
<td>Ralph</td>
<td></td>
<td></td>
<td></td>
<td>☀</td>
<td></td>
</tr>
<tr>
<td>Jean</td>
<td></td>
<td></td>
<td></td>
<td>☀</td>
<td></td>
</tr>
<tr>
<td>Petrisor</td>
<td></td>
<td></td>
<td></td>
<td>☀</td>
<td></td>
</tr>
<tr>
<td>Bogdan</td>
<td>☀</td>
<td>☀</td>
<td>☀</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Philippe</td>
<td></td>
<td></td>
<td></td>
<td>☀</td>
<td></td>
</tr>
<tr>
<td>Dylan</td>
<td></td>
<td></td>
<td>☀</td>
<td>☀</td>
<td>☀</td>
</tr>
<tr>
<td>Louis</td>
<td></td>
<td></td>
<td></td>
<td>☀</td>
<td></td>
</tr>
<tr>
<td>Jaime</td>
<td></td>
<td></td>
<td></td>
<td>☀</td>
<td></td>
</tr>
<tr>
<td>Thomas</td>
<td></td>
<td></td>
<td></td>
<td>☀</td>
<td></td>
</tr>
<tr>
<td>Evangelos</td>
<td>☀</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Salvatore</td>
<td>☀</td>
<td></td>
<td>☀</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cristian</td>
<td></td>
<td></td>
<td></td>
<td>☀</td>
<td></td>
</tr>
<tr>
<td>Steven</td>
<td></td>
<td></td>
<td>☀</td>
<td>☀</td>
<td></td>
</tr>
<tr>
<td>Naren</td>
<td></td>
<td></td>
<td></td>
<td>☀</td>
<td></td>
</tr>
<tr>
<td>Christian</td>
<td></td>
<td></td>
<td></td>
<td>☀</td>
<td></td>
</tr>
<tr>
<td>Koon Ho</td>
<td></td>
<td></td>
<td>☀</td>
<td>☀</td>
<td></td>
</tr>
<tr>
<td>Abhishek</td>
<td></td>
<td></td>
<td></td>
<td>☀</td>
<td></td>
</tr>
<tr>
<td>Renea</td>
<td></td>
<td></td>
<td></td>
<td>☀</td>
<td></td>
</tr>
<tr>
<td>Michael</td>
<td></td>
<td></td>
<td></td>
<td>☀</td>
<td></td>
</tr>
</tbody>
</table>
REVIEWERS:

We gratefully acknowledge the contribution of the following reviewers to the success of the meeting and thank them for taking the time to promote the best science.

George Aninwene II  Louis Kavoussi  Thomas Polascik
Ali Antar  Jayson Kemble  Alan Priester
Robert Carey  Kyo Chul Koo  Roxana Ramos
Ralph Clayman  Thomas Lawson  Rezaee Rezaee
Andrei Cumpaans  Youjin Lee  James Rice
Chiara Gatti  Daniel Leotta  William Roberts
Petrisor Geavlete  Ron Marom  Daniel Massana Roquero
Rory Geoghegan  Salvatore Micali  Nicolas Soputro
Albert Geskin  Steven Monda  Dan Stoianovici
Juan Gonzalez-Pereira  Sakina Mohammed Mota  Gerald Timm
Antonio Gorgen  Gregory Mullen  Rei Unno
Philippe Grange  Maya Overland  Tova Weiss
Dr. George Nagamatsu founded the Engineering and Urology Society 1985.

Dr. Jack Vitenson was the first Society Treasurer in 1985.

Special thanks to Dr. Thomas Lawson for his help in formatting this program.

We thank Michelle Paoli and Debra Caridi for organizing this Annual Meeting.
Through collaboration and innovation, Boston Scientific is the preferred urology clinical and business partner that offers comprehensive breadth and depth of knowledge and products. We apply our experience to help you to proficiently treat your patients and navigate the complexities of healthcare. We present a robust portfolio of relevant innovations, as well as tailored training and solutions – designed and delivered with our unique collaborative approach.

A patient-first philosophy and innovative spirit have helped Cook become a leader in urology. With a focus on stone management and biopsy, we pride ourselves on providing quality solutions without compromise. By uniting with healthcare professionals around the world, we’re committed to advancing treatment and making a difference, together.

At our core, we believe industry-physician collaboration is vital to providing better healthcare. Our Vista® Education and Training programs encourage sharing best practices and learning new techniques using Cook’s latest product innovations.

Vascular Technology Inc. (VTI) is a diversified medical equipment firm specializing in the development, manufacture, and sale of surgical devices, such as disposable Intraoperative Doppler Systems and Remotely Operated Suction Irrigation (ROSI) devices for robotic surgery.

VTI continues to develop superior products and to be a leader in the industry and we are proud to say that all of our products are made completely on our premises in Nashua, NH. The basic foundation of VTI is to serve the medical community by bringing innovative technology and superior quality to their customers, which in-turn enhances your patient’s health care. We are continuously researching for ways to enhance our existing products, and develop new products. Our goal is to build the highest quality equipment at an affordable price. We understand the need for innovation, quality, and service in the healthcare community.
Engineering Urology Society Meeting at the AUA2023
Accreditation Information

Accreditation: The American Urological Association (AUA) is accredited by the Accreditation Council for Continuing Medical Education (ACCME) to provide continuing medical education for physicians.

Credit Designation: The American Urological Association designates this live activity for a maximum of 4.0 AMA PRA Category 1 Credits™. Physicians should claim only the credit commensurate with the extent of their participation in the activity.

Other Learners: The AUA is not accredited to offer credit to participants who are not MDs or DOs. However, the AUA will issue documentation of participation that states that the activity was certified for AMA PRA Category 1 Credit™.

Evidence Based Content: It is the policy of the AUA to ensure that the content contained in this CME activity is valid, fair, balanced, scientifically rigorous, and free of commercial bias.

AUA Disclosure Policy: All persons in a position to control the content of an educational activity (i.e., activity planners, presenters, authors) are required to disclose to the provider all financial relationships with any commercial interest during the previous 24 months. The AUA must determine if the individual’s relationships may influence the educational content and mitigate any conflicts of interest prior to the commencement of the educational activity. The intent of this disclosure is not to prevent individuals with relevant financial relationships from participating, but rather to provide learners information with which they can make their own judgments.

Mitigation of Identified Conflict of Interest: All disclosures will be reviewed by the AUA Conflict of Interest (COI) Review Work Group Chair and/or Vice Chair for identification of conflicts of interest. The AUA COI Review Work Group, working with Office of Education staff, will document the mechanism(s) for management and mitigation of the conflict of interest and final approval of the activity will be documented prior to implementation. Any of the mechanisms below can/will be used to mitigate conflict of interest:

- Peer review for valid, evidence-based content by the AUA COI Review Work Group.
- Attestation that clinical recommendations are evidence-based and free of commercial bias.
- Introduction of a debate format (point-counterpoint)
- Inclusion of moderated panel discussion with unbiased moderator
- Publication of a parallel or rebuttal article for an article that is felt to be biased
- Divestiture of the relationship by faculty
- Recusal from controlling relevant aspects of planning
- Selection of alternative faculty for specific topic

Off-label or Unapproved Use of Drugs or Devices: The audience is advised that this continuing medical education activity may contain reference(s) to off-label or unapproved uses of drugs or devices. Please consult the prescribing information for full disclosure of approved uses.
Society of Urologic Robotic Surgeons Meeting at the AUA2023
Accreditation Information

Accreditation: The American Urological Association (AUA) is accredited by the Accreditation Council for Continuing Medical Education (ACCME) to provide continuing medical education for physicians.

Credit Designation: The American Urological Association designates this live activity for a maximum of 4.75 AMA PRA Category 1 Credits™. Physicians should claim only the credit commensurate with the extent of their participation in the activity.

Other Learners: The AUA is not accredited to offer credit to participants who are not MDs or DOs. However, the AUA will issue documentation of participation that states that the activity was certified for AMA PRA Category 1 Credit™.

Evidence Based Content: It is the policy of the AUA to ensure that the content contained in this CME activity is valid, fair, balanced, scientifically rigorous, and free of commercial bias.

AUA Disclosure Policy: All persons in a position to control the content of an educational activity (i.e., activity planners, presenters, authors) are required to disclose to the provider all financial relationships with any commercial interest during the previous 24 months. The AUA must determine if the individual’s relationships may influence the educational content and mitigate any conflicts of interest prior to the commencement of the educational activity. The intent of this disclosure is not to prevent individuals with relevant financial relationships from participating, but rather to provide learners information with which they can make their own judgments.

Mitigation of Identified Conflict of Interest: All disclosures will be reviewed by the AUA Conflict of Interest (COI) Review Work Group Chair and/or Vice Chair for identification of conflicts of interest. The AUA COI Review Work Group, working with Office of Education staff, will document the mechanism(s) for management and mitigation of the conflict of interest and final approval of the activity will be documented prior to implementation. Any of the mechanisms below can/will be used to mitigate conflict of interest:

- Peer review for valid, evidence-based content by the AUA COI Review Work Group.
- Attestation that clinical recommendations are evidence-based and free of commercial bias.
- Introduction of a debate format (point-counterpoint)
- Inclusion of moderated panel discussion with unbiased moderator
- Publication of a parallel or rebuttal article for an article that is felt to be biased
- Divestiture of the relationship by faculty
- Recusal from controlling relevant aspects of planning
- Selection of alternative faculty for specific topic

Off-label or Unapproved Use of Drugs or Devices: The audience is advised that this continuing medical education activity may contain reference(s) to off-label or unapproved uses of drugs or devices. Please consult the prescribing information for full disclosure of approved uses.