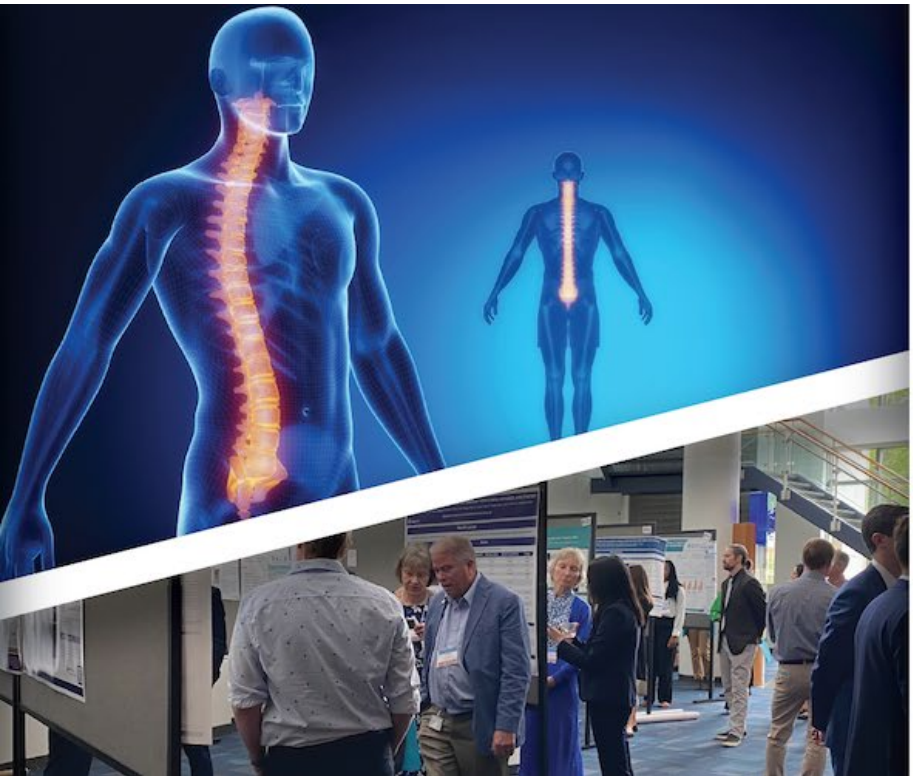

Duke UNIVERSITY
KURe

10th Annual
Multidisciplinary Benign Urology Research Symposium

Artificial Intelligence – Where Are We Now?
&
Advancing the Precision of Neuromodulation in Urology

Trent Semans Center

Duke University

Durham, North Carolina

Wednesday, April 9, 2025

8 am - 4 pm

Duke University School of Medicine

8:00 am **CHECK IN: Obtain the link to the program booklet**

8:15 am **WELCOME AND INTRODUCTIONS:** Cindy L. Amundsen, MD, KURe PI and PD

8:25 am **TRAINEE PODIUM PRESENTATIONS -** Moderator: **Lenaine Westney, MD**

Ananya Pinnamaneni, Duke University
Estrogen-Dependent mechanisms increase urothelial c-fiber populations and contribute to the pathogenesis of overactive bladder in female type 1 diabetic Akita mice
Bin Ni, MD, PhD, Duke University, KURe Scholar
Assessing incidence, risk factors, and outcomes of BK virus-related complications following kidney transplantation
Mina Ghatas, MSc, Virginia Commonwealth University (VCU**)**
A preliminary study utilizing Bladder NIRS as a non-invasive approach to detect detrusor overactivity in patients with OAB

9:15 am **POSTER SESSION-1** (odd numbered posters)

10:15 am **FEATURED SPEAKER -** Moderator: **Ashley Johnston, MD**

Susannah Rose, PhD, Vanderbilt University Medical Center
Meaningful Ethical Considerations in Healthcare AI

10:45 am **PANEL DISCUSSION -** Moderators: **Farshad Samadifam, MS** and **Aaron Stewart, MD**
Artificial Intelligence — Where Are We Now?
Practical Considerations for AI in Urogynecology and Urology

Jim Hokanson, PhD, Marquette University
Giulia Ippolito, MD, University of Michigan
David Sheyn, MD, Case Western Reserve

11:50 am **LUNCH** *or* **CONVERSATIONS and LUNCH WITH THE EXPERTS**
Pre-registration required for conversations with experts at assigned tables

12:50 pm **POSTER SESSION-2** (even numbered posters)

1:50 pm **PANEL DISCUSSION -** Moderators: **Daniel Marshall, BS** and **Nuhame Mulugeta, MPH**
Advancing the Precision of Neuromodulation in Urology

Adam Klausner, MD, Virginia Commonwealth University
The Brain-Bladder Connection: Improving OAB Diagnostics and Optimizing Sacral Neuromodulation with Functional Near Infrared Spectroscopy (fNIRS)
Aaron Mickle, PhD, Medical College of Wisconsin
Advances in optogenetic neuromodulation of bladder function
Andrew Shoffstall, PhD, Case Western Reserve
Keep It Simple Sacral "KISS" Neuromodulation with an Injectable Electrode

3:00 pm **TRAINEE PODIUM PRESENTATIONS -** Moderator: **Maryellen Kelly, DNP, CPNP**

Natasha Wilkins, PhD, Duke University, KURe Scholar
Sacral nerve stimulation for the restoration of bowel function after spinal cord injury
Aaron Stewart, MD, Duke University
Enhancing urology referral intake through artificial intelligence-assisted pre-charting: A pilot study
Gabriella Robilotto, BS, Medical College of Wisconsin
Optical inhibition of OPN3 with transdermal light reduces nociceptive behaviors in mice and acute cystitis

3:50 pm **EVALUATIONS** Please complete the symposium evaluation while we transition.

3:55 pm **PRESENTATION OF TRAINEE AWARDS AND CLOSING REMARKS**

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Nuhame Mulugeta	Virginia Commonwealth University
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Trainee Poster Presentation Awards

Jim Hokanson, PhD
Giulia Ippolito, MD, MS
Adam Klausner, MD
Aaron Mickle, PhD
Susannah Rose, PhD
David Sheyn, MD
Andrew Shoffstall, PhD
Kent Weinhold, PhD

S-01 - Meaningful Ethical Considerations in Healthcare AI

Susannah Rose, PhD,
Vanderbilt University Medical Center

Artificial intelligence (AI) is revolutionizing healthcare, transforming everything from image recognition to robotic surgeries. These cutting-edge technologies are embedded in clinical decision support tools within electronic medical records, offering unprecedented capabilities. However, to truly address the significant challenges faced by physicians, healthcare systems, and patients, it's crucial that these stakeholders not only understand AI but actively engage in its development and implementation. Without their critical input, AI systems risk being ineffective and poorly designed.

This presentation will provide an engaging overview of AI in healthcare, highlighting key ethical and organizational concerns through real-world case examples. It will empower the audience with practical steps to become proactive participants in this transformative era. Join us as we navigate the exciting and sometimes daunting landscape of AI in healthcare.

S-02 - Panel: ***Artificial Intelligence — Where Are We Now?: Practical Considerations for AI in Urogynecology and Urology***

Jim Hokanson, PhD, Marquette University,
Giulia Ippolito, MD, University of Michigan,
David Sheyn, MD, Case Western Reserve

Drs. Ippolito, Sheyn, and Hokanson will review clinical and research aspects of the application of Artificial Intelligence (AI) in the fields of Urogynecology and Urology. Dr. Ippolito, with a background in urology, and Dr. Sheyn, with a background in gynecology, are practicing urogynecologists and surgeon-scientists with experience in prediction models for functional urologic care. Dr. Hokanson, an expert in Biomedical Engineering, leads a lab specializing in development of novel therapies for urological dysfunction and the use of AI technologies to improve treatment selection and design.

Together, they will navigate the practical aspects of integrating AI into clinical practice and discuss the current state of AI in the field with respect to Urology and Urogynecology. Dr. Hokanson will delve into AI's role in developing and evaluating clinical prediction models. Recent models will be discussed, along with an assessment of their potential current utility, their limitations, and opportunities for improvement. Dr. Ippolito will explore AI's clinical applications, including Generative AI, Ambient AI, and tools for surgeons. Lastly, Dr. Sheyn will provide a critical review of the potential challenges and risks associated with AI in healthcare.

Panel: ***Advancing the Precision of Neuromodulation in Urology***

S-03 - The brain-bladder connection: Improving OAB diagnostics and optimizing sacral neuromodulation with functional near infrared spectroscopy (fNIRS)

Adam Klausner, MD, Virginia Commonwealth University

This talk is focused on the brain-bladder connection in Overactive Bladder. Overactive bladder is highly prevalent (up to 40% of adult women over the age of 40), results in major quality of life impact, and is responsible for a massive economic burden on the U.S. health care system. OAB is currently diagnosed based on patient symptoms and validated surveys. Because there are no objective tests for OAB, treatment often follows an algorithm and is based on trial-and-error. Therefore, it is not surprising that many OAB treatments have limited efficacy and are limited by lack of compliance and side effects. Urodynamics can help identify contributory pathologies such as detrusor overactivity but, is itself invasive, expensive, and poorly reproducible. The problem is a lack of tools to objectively and non-invasively diagnose OAB and to guide therapy. Armed with this major gap in knowledge, our mechano-urology research group combining the expertise of urology (Adam Klausner from VCU), Lynn Sothers from UCLA), urogynecology (Linda Burkett from VCU), and mechanical engineering (John Speich from VCU) has investigated the role of functional Near Infrared Spectroscopy (fNIRS) of the brain as a novel diagnostic tool for OAB. fNIRS is a non-invasive technique which measures real-time oxyhemoglobin in superficial tissues like the cerebral cortex. In this talk, we will show how the prefrontal cortex, which is easily accessible using fNIRS, plays an important role in the pathophysiology of OAB. fNIRS methodology and results from our research group and others will be discussed. Data comparing individuals with and without OAB will be presented as well as data from individuals who have been successfully treated with Sacral Neuromodulation (SMN). The goal will be to shed some new light (infrared of course) on the brain-bladder connection.

S-04 - Advances in optogenetic neuromodulation of bladder function

Aaron Mickle, PhD, Medical College of Wisconsin

Neuromodulation of bladder function typically involves electrical stimulation neurons in the peripheral or central nervous system. Optogenetics was developed as basic neuroscience technology that allows for the manipulation of neuron populations by genetic expression of light-activated channels in specific populations of cells. Dr. Mickle will discuss the advances in opsin technology and the targeting of optogenetic neuromodulation to the lower urinary tract.

S-05 - Keep It Simple: Sacral "KISS" Neuromodulation with an Injectable Electrode

Andrew Shoffstall, PhD, Case Western Reserve University

KISS (“Keep it simple, Stupid”) is a common idiom used in engineering (and elsewhere), which instructs the designer to design simple systems. The main reason: Complex systems are more prone to failure. Implanted devices in the brain, spinal cord, and peripheral nervous system have many exciting applications for treating chronic clinical conditions (e.g., chronic pain, Parkinson’s tremor, epilepsy, spinal cord injury). These devices electrically stimulate or record neural activity. A significant amount of funding from public and private entities is being invested to discover and further develop devices for a wide range of clinical applications. These applications have been classified as ‘neuromodulation’, ‘electroceuticals’, or ‘bioelectronics’. While non-invasive solutions exist, due to their reliability and target engagement specificity, implanted neural interface devices remain the gold standard for engaging with the nervous system tissues. However, the surgery to implant devices may limit the wide-spread adoption of neural interface technology by patients due to the real, or even just perceived, risks of the invasive surgery. In this talk, recent progress on a number of approaches to achieve a minimally invasive neural interface, coined the Injectrode®, will be presented. We will present several iterations of the device concept, design and prototypes which we have progressively simplified to remove unnecessary complexity from the system.

Podium-01: Basic Science Top Abstract

Estrogen-dependent mechanisms increase urothelial c-fiber populations and contribute to the pathogenesis of overactive bladder in female type 1 diabetic Akita mice

Ananya Pinnamaneni[1], Francis Hughes Jr. PhD[2], J. Todd Purves MD/PhD[2], Michael Odom PhD[2]

[1]Duke University, Durham, NC, USA. [2]Duke University School of Medicine, Durham, NC, USA

Introduction/Objectives: Diabetes is associated with up to a 77% increase in the prevalence of overactive bladder (OAB) symptoms, making OAB the most common presentation in half the number of patients with diabetes. A key characteristic of OAB is hyperexcitability of afferent nerves innervating the bladder, which is attributed to an extensive network of c-fiber nerves in the bladder urothelium. The growth of urothelial c-fiber nerves is partially regulated by estrogen-dependent mechanisms. Notably, in diabetic animal models, estrogen-dependent signaling pathways have been implicated in the development of autonomic dysregulation, cardiac dysfunction, and benign prostatic hyperplasia. However, the influence of diabetes on estrogen-dependent mechanisms regulating micturition remains unclear. We hypothesized that estrogen-dependent mechanisms are responsible for the growth of urothelial c-fiber nerves and the development of diabetes-induced OAB. To test this hypothesis, we assessed *in vivo* bladder function and quantified urothelial c-fiber populations in female type 1 diabetic Akita mice that were either gonadally intact or ovariectomized.

Methods: Female type 1 diabetic Akita mice with a C57BL/6J background and non-diabetic C57BL/6J mice were either ovariectomized at 8 weeks of age or remained gonadally intact. At 15 weeks of age, *in vivo* bladder function was assessed in all groups using awake-restrained cystometry to determine void volume and void frequency (n= 9-11 per group). Additionally, in diabetic, non-diabetic, and ovariectomized diabetic mice (n = 6 per group), standard immunofluorescence techniques were employed to label transverse bladder sections with calcitonin gene-related peptide, a marker of c-fiber nerves. The number of c-fibers was quantified and normalized to the total urothelial area. Statistical significance, defined as $p<0.05$, was calculated using a one-way analysis of variance with Tukey post hoc tests to compare all groups.

Results: Diabetic mice exhibited a significant reduction in void volume and an increase in voiding frequency compared to non-diabetic controls, consistent with signs of OAB. Additionally, diabetic mice showed a significant increase in the number of urothelial c-fiber nerves, correlating with the OAB phenotype. Interestingly, ovariectomized diabetic females failed to develop any discernible signs of OAB, as their void volumes and frequencies significantly differed from those of gonadally intact diabetics and remained comparable to non-diabetic mice. Ovariectomy did not significantly affect the voiding parameters of non-diabetic mice. Consistent with the absence of an OAB phenotype, ovariectomized diabetic mice displayed a significantly lower number of urothelial c-fibers compared to gonadally intact diabetic mice, with levels similar to those observed in non-diabetic controls.

Conclusions: Diabetes upregulates estrogen-dependent mechanisms responsible for the growth of urothelial c-fibers and consequently the onset of OAB. Further elucidation of the precise mechanisms by which estrogens impact afferent nerves innervating the diabetic bladder may identify novel therapeutic targets to prevent or potentially treat OAB.

Research areas: diabetes, overactive bladder (OAB), voiding dysfunction / urinary retention

Podium-02: Clinical Science, Top Abstract

Assessing incidence, risk factors, and outcomes of BK virus-related complications following kidney transplantation

Bin Ni MD, PhD, Scott Sanoff MD, MPH, Xunrong Luo MD, PhD, J. Eric Jelovsek MD, Barbara Alexander MD

Duke University, Durham, NC, USA

Introduction: BK polyomavirus, acquired in childhood, remains latent in the renourinary tract and can reactivate in renal transplant recipients, causing complications like ureteral stenosis and BK virus-associated nephropathy (BKVAN). Reported frequencies vary due to differences in transplant practices and immunosuppression. This study updates the epidemiology of BK reactivation, identifies risk factors, and evaluates associated outcomes in renal transplant recipients

Methods: This retrospective study included all renal transplant recipients at Duke University Hospital from January 1, 2016, to December 31, 2020. Clinical and demographic data, including BK reactivation and outcomes, were abstracted from medical records, while donor data were obtained from the UNOS STAR database. Univariable analysis was performed using logistic regression, and variables with a *p*-value < 0.10 were included in the multivariable model.

Results: During the study period, 818 patients underwent renal transplantation and had at least 30 days and up to 2 years of post-transplant follow-up. BK DNAemia occurred in 301 (36.8%) patients, of whom 47 (5.7%) developed biopsy-proven BK virus-associated nephropathy (BKVAN). Ureteral stenosis or obstruction was observed in 37 (4.5%) patients. Among those with BK DNAemia, a higher peak viral load (median 3095 copies/mL without BKVAN vs. 210,000 copies/mL with BKVAN; $p = 5.69 \times 10^{-6}$) and longer duration of viremia (median 77.5 days without BKVAN vs. 398 days with BKVAN; $p = 3.11 \times 10^{-10}$) were significantly associated with the development of BKVAN. In univariable analysis, older age at transplant, male sex, non-Hispanic/Latino ethnicity, ABO mismatch, presence of a ureteral stent, longer cold ischemic time, and lack of basiliximab induction were associated with persistent BK DNAemia (≥90 days). In multivariable analysis, all factors except for ureteral stent and ethnicity remained significant predictors of persistent BK DNAemia. The duration of BK DNAemia post-transplant was not associated with rejection ($p = 0.182$) but was significantly associated with graft dysfunction at two years post-transplant ($p = 0.027$). In contrast, high-level BK viremia (>10,000 copies/mL) or BKVAN was significantly associated with rejection ($p = 0.005$) but not with graft dysfunction ($p = 0.090$).

No/Limited BK DNAemia (n=665, 81.3%) vs. Persistent BK DNAemia (n=153, 18.7%)			
Variable	**Univariable**	**Multivariable**	
	p-value	Adjusted OR (CI 95%)	*p*-value
Transplant age	0.00349	1.020 (1.005-1.036)	0.0121
Sex (ref: male)	0.0525	0.676 (0.463-0.979)	0.0404
Ethnicity (ref: non-Hispanic/Latino)	0.0987	0.196 (0.011-0.960)	0.1143
ABO match (ref: yes)	0.0752	4.000 (1.142-12.965)	0.0221
Ureteral stent (ref: no)	0.0517	-	-
Cold ischemic time	0.0522	1.000 (0.999-1.001)	0.0504
Basiliximab induction (ref: no)	0.0755	0.556 (0.311-0.940)	0.0363

Conclusions: Persistent BK DNAemia after renal transplantation was associated with older age, male sex, ABO mismatch, and prolonged cold ischemic time, while basiliximab induction was protective. Although prolonged BK viremia correlated with graft dysfunction at two years, high-level viremia or BKVAN was more strongly linked to rejection, underscoring the importance of early risk stratification and targeted management strategies.

Research Areas: Infections of the Urinary Tract, Clinical Outcomes Research

Podium-03: Translational Science, Top Abstract

A preliminary study utilizing Bladder NIRS as a non-invasive approach to detect detrusor overactivity in patients with OAB

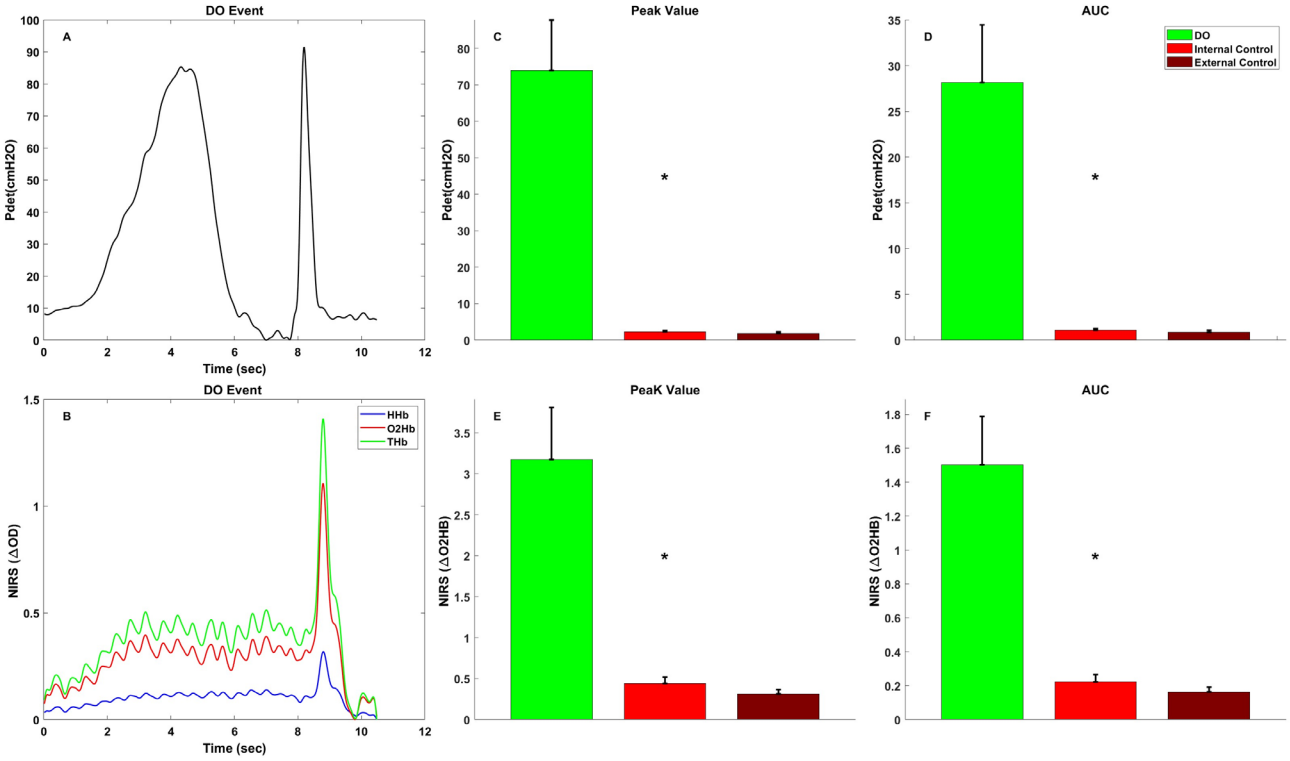
Mina Ghatas Msc[1], Ethan Casto Bsc[1], Kaitlyn Maddra MD[1], Linda Burkett MD, MS[2], Nyasia Jones MD[1], John Speich PhD[3], Adam Klausner MD[1]

[1]Dept. of Surgery/Division of Urology, [2]Dept. of Obstetrics and Gynecology, [3]Dept. of Mechanical and Nuclear Engineering; Virginia Commonwealth University Health System, Richmond, VA,

Introduction/Objective: Detrusor overactivity (DO) involves involuntary bladder contractions which may contribute to overactive bladder (OAB) symptoms such as frequency, urgency, and incontinence. Urodynamics (UDS) is the current gold-standard but invasive and uncomfortable test for detecting DO. Near-infrared spectroscopy (NIRS) is a non-invasive, cost-effective imaging tool that measures tissue hemodynamics. The objective of this study was to utilize bladder NIRS as a non-invasive tool for detecting DO in OAB patients.
Methods: OAB patients (characterized by ICIq-OAB and OABV3 surveys) underwent simultaneous bladder NIRS and clinically indicated UDS testing. Signal comparison was made between continuous O_2HB NIRS and detrusor pressure (Pdet). UDS DO events (confirmed by a board-certified urologist and urogynecologist) and control periods were used for comparison from both individuals with and without DO events. NIRS and Pdet DO and control segments were analyzed for peak values and area under the curve (AUC). Finally, the normalized AUC for NIRS data over the full testing period was calculated after motion artifact correction, with the area of a linear fit subtracted to account for any data drift.
Results: Twenty-seven female participants with OAB were enrolled, four of whom had confirmed DO (n=13 events). Internal control segments (n=13) were used from the same participants and external controls were obtained from eight participants without DO. Peak values and AUC for Pdet and O_2HB signals were significantly higher in the DO group compared to the internal and external control groups. Peak Pdet values were 73.9 ± 49.6 cmH_2O (DO), 2.2 ± 1.2 cmH_2O (internal control) and 1.8 ± 1.5 cmH_2O (external control), ($p < 0.05$). AUC for Pdet segments was 28.1 ± 22.6 cmH_2O (DO), 1.1 ± 0.6 cmH_2O (internal control) and 0.8 ± 0.7 cmH_2O (external control), ($p < 0.05$). Peak values for the corresponding NIRS O_2HB segments were 3.1 ± 2.2 cmH_2O (DO), 0.4 ± 0.3 cmH_2O (internal control), and 0.3 ± 0.2 cmH_2O (external control), ($p < 0.05$). AUC for O_2HB segments was 1.5 ± 1.03(DO), 0.2 ± 0.1 (internal control), and 0.1 ± 0.1 (external control), ($p < 0.05$). Finally, the normalized AUC over the full testing period was 0.72 ± 0.4 (DO) and 0.06 ± 0.03 (internal control), ($p < 0.05$).
Conclusion: Segments with confirmed DO showed higher AUC and peak values for corresponding Pdet and NIRS data compared to controls. Additionally, normalized AUC for NIRS signals was higher in DO patients than in those without DO. These findings support bladder NIRS as a potential, non-invasive tool for DO detection in OAB patients.

Figure on next page

Research Areas: Overactive Bladder, Urodynamics



Legend:

A: *Pdet segment during the detected overactivity (DO) event.* **B:** *NIRS data (oxygenation - O_2Hb, de-oxygenation - HHb, and total hemoglobin - THb) for the corresponding DO event.* **C-F***: Mean ± SEM for Peak Value and Area Under the Curve (AUC) for Pdet and O2Hb NIRS data across 13 events of detected overactivity (DO), matched control events for patients without DO (External Control), and control segments for patients with DO (internal Control) groups, respectively (n = 13 segments each).*

Podium-04: Basic Science, KURe Scholar

Sacral nerve stimulation for the restoration of bowel function after spinal cord injury

Natasha Wilkins PhD, Warren Grill PhD

Biomedical Engineering, Duke University, Durham, NC, USA

Introduction/Objective: Traumatic spinal cord injury (SCI) impacts multiple organ systems and has the potential to impact quality of life significantly. In individuals with SCI, bowel dysfunction including chronic constipation, slow colonic transit, and incontinence are common, impacting 80% of persons living with SCI. Sacral nerve stimulation (SNS) is a minimally invasive, FDA-approved treatment in use for the treatment of bladder and bowel dysfunction in individuals without spinal cord injuries. We are developing a novel paradigm of SNS that uses temporal patterns to differentiate between promoting continence to treat fecal incontinence and increasing colonic motility to treat chronic constipation in a rodent model of SCI.
Methods: Six Sprague Dawley rats (female n=3, male n=3) with thoracic contusion spinal cord injuries underwent acute SNS under urethane anesthesia at four weeks post-injury. SNS was applied with three different stimulation paradigms (14 Hz continuous stimulation, 30 seconds of stimulation at 18 Hz followed by 80 seconds without stimulation, and 40 seconds of stimulation at 20 Hz followed by 20 seconds without stimulation) for 5 minutes each at 0.8-1.25X motor threshold. During SNS, changes in rectal and colon pressure, at 6, 5, and 4 cm from the anal verge, and electromyography of the external anal sphincter were recorded to measure changes in colonic motility.
Results: Repeated measures ANOVA revealed that there were no significant differences in average colonic pressure between periods with SNS vs. periods without SNS, regardless of stimulation parameters. A small difference was seen in the number of contractions above 5 mmHg in which animals exhibited 0.72 (+/-0.46) contractions per 5-minute collection period without SNS and exhibited 1.33 (+/- 0.42), 1.00 (+/- 0.33), and 1.11 (+/- 0.28) per 5-minute period with continual stimulation at 14 Hz, burst stimulation at 18 Hz, and burst stimulation at 20 Hz respectively. Despite these differences, SNS stimulation paradigm did not have a statistically significant impact on the number of bowel contractions.
Conclusions: Although previous research conducted in intact rats has shown that SNS parameters can have a large impact on bowel function, this intervention may need to be individually tailored in cases of SCI.

Research Areas: Innovative technologies, Therapeutic development, Other

Podium-05: Clinical Science, Top Abstract

Enhancing urology referral intake through artificial intelligence-assisted pre-charting: a pilot study

Aaron Stewart MD[1], David Barquin MD[1], Ezra Margolin MD[1], Megan Bock MD[1], Daniel Wollin MD[2], Bristol Whiles MD[3], Russell Terry MD[4], David Sobel MD[5], Charles Scales MD[1], Gary Faerber MD[1], Jodi Antonelli MD[1], Michael Lipkin MD[1], Glenn Preminger MD[1], Robert Medairos MD[1]

[1]Department of Urology, Duke University Hospitals, Durham, NC, USA. [2]Department of Urology, Brigham and Women's Hospital, Boston, MA, USA. [3]Department of Urology, University of Kansas Medical Center, Kansas City, KS, USA. [4]Department of Urology, University of Florida College of Medicine, Gainsville, FL, USA. [5]Department of Urology, Maine Medical Center, Portland, ME, USA

Introduction: The use of artificial intelligence (AI) in healthcare is growing, which can improve providers' clinical workflow and assist in the synthesis of healthcare data. We aimed to assess how AI can assist in pre-charting new patient referrals to a tertiary urologic kidney stone clinic.
Methods: Ten patients who were referred for kidney stone disease to a single academic center between October 2022 and November 2023 were randomly selected for review. The referral packets were scanned PDF packets and varied in length from 10 to 44 pages. Hona (Hona AI, San Francisco, CA), a web-based artificial intelligence software, was used to provide a pre-templated clinical summary of the referral packet. Five fellowship-trained endourologists from different academic centers were assigned to pre-write a non-templated clinic note for each of the ten patients. Assignments were randomized such that each physician completed five notes with AI assistance and five without. The time to create each clinic note was recorded. After completion of all ten charts, the physicians were asked to complete a satisfaction survey. Each clinic note was evaluated using the Physician Documentation Quality Instrument (PDQI-9) by two separate authors, and these scores were averaged. Outcomes were compared using Wilcoxon rank-sum tests, with $p<0.05$ indicating statistical significance.
Results: A total of 50 notes were written, 25 with and 25 without AI assistance. Median note writing time was 8.2 min (IQR 7.0-10.2) for AI-assisted notes and 9.4 min (IQR 8.4-11.7) for non-AI-assisted notes, representing a 13% reduction in time for note generation with AI assistance ($p=0.048$). The median total PDQI-9 score was 42.5 for AI-assisted notes and 42.0 for non-AI-assisted notes ($p=0.321$). AI-assisted notes scored significantly higher on being "up-to-date" (median 5 vs. 4.5, $p=0.020$); there were no other significant differences on PDQI-9 questions (Figure). Clinicians were either "very satisfied" or "somewhat satisfied" with the AI software overall. All five clinicians "strongly agreed" that the AI-generated report is superior to the current standard referral documents in their practice.

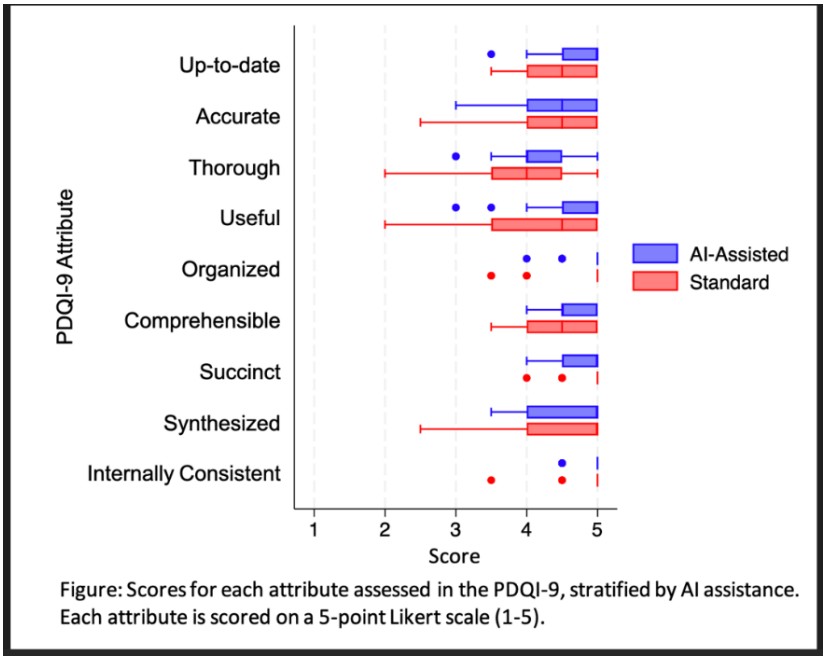


Figure: Scores for each attribute assessed in the PDQI-9, stratified by AI assistance. Each attribute is scored on a 5-point Likert scale (1-5).

Conclusion: For urology referrals, AI assistance led to faster creation of a pre-clinic note without compromising note quality. All the physicians involved preferred the AI assistance to the current standard referral document in their practice.

Research Areas: Artificial Intelligence, Innovative Technologies, Nephrolithiasis

Podium-06: Basic Science, Top Abstract

Optical inhibition of OPN3 with transdermal light reduces nociceptive behaviors in mice with acute cystitis.

Gabriella Robilotto BS[1], Rebecca Bornstein PhD[2], Daniel Zelmanoff MD, PhD[2], Nia Dufeal BS[3], Ofer Yizhar PhD[2], Aaron Mickle PhD[1]

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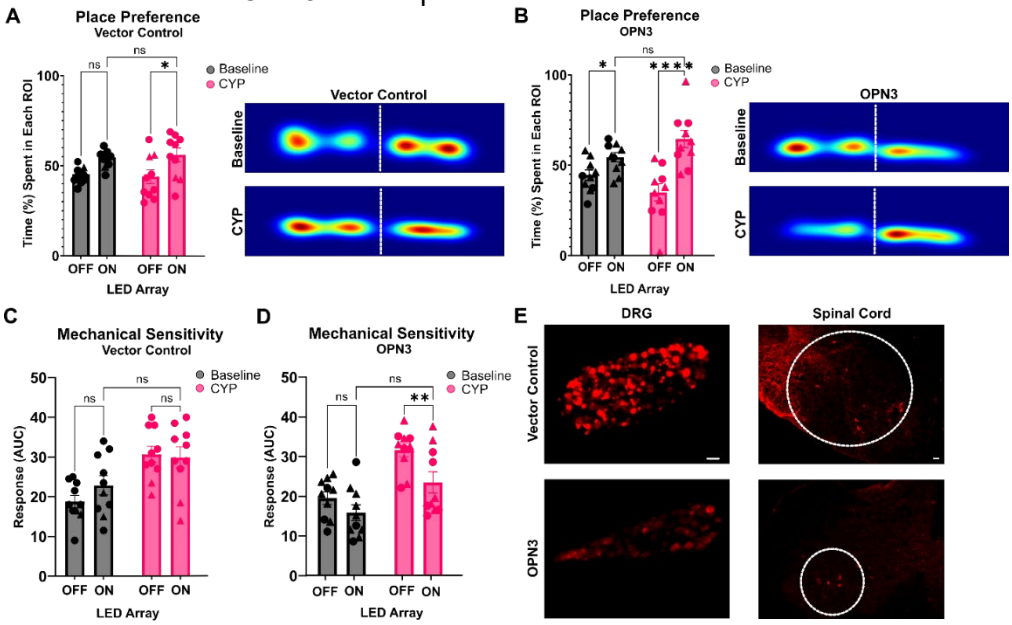
Introduction: Optogenetic tools are used to better understand neural circuits, however, inhibiting these neural pathways remains challenging. Common inhibitory opsins pose difficulties with prolonged inhibition and can cause off-target effects, this is especially challenging when targeting bladder innervation. These techniques require surgical implantation of fiber optics or wireless devices to activate opsins in freely moving animals, furthering animal stress and surgical complications. Here, we used a mosquito-derived homolog of mammalian encephalopsin/panopsin protein (OPN3), packaged into PHP.S, an AAV serotype used to inhibit neurotransmission *in vivo* with red light activation. In addition, red light provides deeper tissue penetrance than traditional green or blue light. Collectively, this optogenetic technique allows us to optically inhibit primary sensory neurons with transdermal red LED light. Therefore, we hypothesize that transdermal light-activated OPN3 will inhibit neurotransmitter release by primary sensory afferents and suppress bladder nociceptive behaviors in mice. **Methods:** We injected AAV PHP.S-OPN3-mScarlet or viral vector control intraperitoneally (IP) into neonatal mice postnatal day 3 for broad peripheral nervous system transduction. On day 84, we performed baseline assessments, place preference, and tested abdominal hypersensitivity through von Frey with and without optical inhibition with LED illumination. A single IP cyclophosphamide injection was administered to induce acute bladder cystitis, and the behavioral assessments were repeated. Lastly, the dorsal root ganglia (DRG) and spinal cord tissue were harvested and evaluated for OPN3 viral expression.



Results: OPN3 mice spent more time in the red LED-illuminated chamber after acute cystitis (**B**) and had less abdominal sensitivity in response to noxious stimuli upon LED stimulation (**D**). The data suggests some nociceptive suppression with LED illumination. Furthermore, we expected expression of the primary sensory neurons of the L6-S1 DRG and the projections into the dorsal horn of the L4-L6 spinal cord innervating the bladder. We found robust OPN3 expression in the L6-S1 DRG and minimal expression within the spinal cord interneurons (**E**). **Conclusions:** This technique offers a novel optogenetic approach *in vivo* that does not require surgical intervention to manipulate neural pathways. OPN3 may have inhibitory effects on bladder nociceptive responses in mice, however, further studies are needed to fully understand bladder pain neural pathways.

Funding: Rita Allen Foundation and NIH-EB031249

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Even poster numbers are presented in the PM session (12:50 – 1:50)

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P-01

Preliminary data from a quality improvement project targeting traumatic catheterization

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Introduction/Objective(s): Traumatic urethral catheterization occurs daily in hospitals throughout the United States. The result is poor patient outcomes, increased costs for hospitals and patients, and excess workload on urologic services. The Coude catheter improves successful catheterization rates and reduces catheter related trauma in males by accommodating the natural curvature of the male urethra. Despite this Coude catheter protocol and formal education in Coude catheter placement are not commonplace. This results in traumatic catheterizations, repeated catheterization attempts, increased patient and hospital expenses, and unnecessary urology consultation. We set out to create a quality improvement project aimed at reducing rates of traumatic catheterization by incorporating Coude catheter education and policy.
Methods: We constructed a pre-post intervention study to analyze traumatic catheterization rates before and after a Coude catheterization protocol. This included a retrospective chart review to determine rates of consultations for difficult foley catheter placement at our institution by unit. Three units with high utilization were selected. Pre-intervention surveys were conducted by nurses in these units for each foley catheter that was placed on a male patient. The surveys recorded patient age, type and size of initial catheter used, number of required attempts and if a urology consultation was placed. Survey data was collected in a password-protect REDCap database.
Results: In our pre-intervention phase, 30 male patients had surveys completed for catheter placement. Of those 30, 7 required more than one catheterization attempt (23%). Six patients underwent two attempts: three (10%) had failed attempts with a 16fr straight catheter and required urology consultation. Two patients had successful placement with a 16fr Coude after failing with a 16fr straight catheter. One had a successful second attempt with a 16fr straight catheter after an initial failure with a 14fr straight catheter. One patient underwent three failed attempts with a 16fr straight catheter and required urology consultation.
Conclusion(s): Survey data from 3 different nursing units demonstrated that 23% of male patients required repeat catheter attempt after initial placement with a straight catheter. Of the two patients that had Coude catheters placed, they did not require urology consultation for catheter placement. An intervention phase with a catheterization protocol incorporating nursing education and post-intervention survey collection will assess reduction in traumatic catheterization rates and determine the viability of such a protocol in a large academic setting.

P-02

Exosomes for atrophy: acellular regenerative biologic for estrogen-deprivation vaginal atrophy in a porcine model

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Introduction/Objectives: Female vaginal dryness causes feelings of discomfort, dyspareunia, and difficulty with sexual intercourse; it results from atrophy of vaginal tissues either from post-menopausal state or estrogen deprivation from procedures or pharmacologic treatments such as aromatase inhibitors for breast cancer. Vaginal estrogen cream is the gold standard for treatment; however, select patients cannot use vaginal estrogen due to risk factors such as a history of estrogen receptor positive breast cancer. Our objective is to evaluate the efficacy of a regenerative biologic, exosomes, in a porcine model for possible translation as a clinical treatment for vaginal atrophy.

Methods: We completed a bilateral oophorectomy in 8 York-shire-crossed pigs to eliminate ovarian estrogen production over the 12-week study period. Animals received a baseline injection of exosomes suspended in hyaluronic acid (HA) or hyaluronic acid-alone (control). Exosomes were injected in a grid pattern into the fibromuscular tissue of the vagina. Tissues were harvested at 12 weeks and gross photography was taken. Tissues were stained for H&E, Masson's Trichrome, and PAS per standard protocols. Tissues were analyzed for comparison of epithelial thickness, count and depth of vaginal papillae, neovascularization per high power field (measured as a count of vessels in cross section), and collagen content (measured in ImageJ through color deconvolution) and organization. Summary statistics of tissue characteristics were summarized by group and tested for differences using Wilcoxon rank sum test. A mixed effect model for repeated measurements was fit for each outcome.

Results: Gross assessment showed more vaginal rugae and pink rather than pale pigmentation in treatment samples. Median epithelial thickness between treatment and control groups was 19.6 μm [17.9, 20.4] and 23.2 μm [14.4, 24.1], p=1.0. Median number of blood vessels per of 1 mm^2 high powered field between treatment and control groups was 49.8 [41.1, 51.8] and 41.1 [38.4,45.4], p=0.29. (include papillae/length results). Median papillae number per millimeter of epithelial length in treatment and control groups was 0.1 [0.1-0.2] and 0.0 papillae/mm [0.0-0.1], p=0.07. Median papillae depth for treatment and control groups was 19.6 μm [15.2, 21.4] and 19.3 [13.2, 29.0], p=1.0. Median collagen content percent per sample between treatment and control groups was 54.5% [54.1, 54.8] and 59.1% [54.5, 59.1], p=0.5510. None of the histologic comparisons were statistically significant.

Conclusions: This preliminary study is an exploratory use of exosomes for vaginal tissue regeneration and possible use as a treatment for vaginal atrophy due to estrogen deprivation. Prior study of the use of exosomes on the vagina has shown increased neovascularization and epithelial thickness. The small sample showed trends with no statistical significance, though demonstrates proof of concept and provides summary statistics for sample size calculations for future studies. Non-estrogen treatments are needed for vaginal atrophy given current therapies involve minimally effective vaginal moisturizers and vaginal lasers that have significant out of pocket cost to the patient. An injectable regenerative biologic would give patients options for increased lubrication, comfort, and sexual satisfaction, without the increased risks associated with estrogen exposure in vulnerable populations.

Research Areas: Aging, Female Pelvic Medicine, Regenerative Medicine/ Tissue Engineering

P-03
Modeling Developmental Neurotoxicity Using a hiPSC-derived Mini-Brain Model

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Developmental neurotoxicity (DNT) poses a profound human health risk. Exposures to environmental toxicants during fetal development adversely impacts the trajectory of the developing nervous system, altering neural architecture, function, and the epigenetic landscape. These perturbations result in enduring neurological deficits that manifest throughout an individual's life. DNT remains poorly studied, being one of the least explored outcomes in response to toxic exposures. Nervous system development is marked by processes such as neurogenesis, gliogenesis, and synaptogenesis that unfold across well-defined temporal periods, resulting in multiple windows of xenobiotic susceptibility. Therefore, only a handful of compounds have been classified as developmental neurotoxicants. Whole vertebrate animal models such as rodents were conventionally prioritized in the study of neurodevelopment and developmental neurotoxicity. However, the difficulty of species extrapolation using these *in vivo* approaches has limited their human translatability. The advent of induced pluripotent stem cells (iPSCs) represents a significant breakthrough in neurotoxicology. With their innate ability to self-renew and differentiate into mature cell types, iPSCs have provided a highly granular and sensitive method for studying different neurodevelopmental stages. We aim to capture this elaborate framework using the *Brain Spheres* model. This cutting-edge *in vitro* system mirrors several *in vivo* processes that occur during the development of the prenatal human brain during early to mid-gestation. Using this model, we aim to identify critical windows of vulnerability during neural development, where toxicants such as cannabis and heavy metals can alter cellular fate, impair synaptic plasticity, and affect neurochemical signaling. Furthermore, we will also explore the impact of cannabis exposure on the epigenetic landscape of the nervous system, focusing on changes in DNA methylation patterns and examining alterations in gene expression profiles to tie them directly to neurodevelopmental outcomes. By integrating cellular, functional, and epigenetic analyses, our project aims to comprehensively understand toxicants' effects on the developing brain.

P-04

Reliability through Accelerometer Based Motion Correction Optimizing NIRS and fNIRS Signal Analytics

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Introduction: Near-infrared spectroscopy (NIRS) is a noninvasive technique that measures oxyhemoglobin (O_2Hb) concentration in tissues to track hemodynamic changes, with functional NIRS (fNIRS) focusing on the cortical brain. Applied in urologic research over the anterior bladder wall, NIRS sensitivity can be affected by motion artifacts. This study aims to improve data reliability by identifying and correcting these disturbances, enhancing signal consistency and reproducibility.
Methods: Female and male participants (n=11) without symptoms of urinary urgency or known voiding dysfunction completed a validated oral two-fill hydration protocol. The Artinis Brite functional NIRS (headcap over frontal cortex) and Portalite NIRS (abdominal wall) systems were used for continuous O_2Hb concentration measurement. These devices, one on head and other on the abdominal wall, contain an inertial measurement unit (IMU) or accelerometer to detect motion in three axes of direction. The IMU output for directional angulation is a combined Euclidian vector, square root of $X^2 + Y^2 + Z^2$. During the first fill, participants completed a series of activities, including head tilt (bending at the neck, chin to chest) and waist tilt (pelvic tilts while seated), for 30 secs followed by one minute still period at low sensation of bladder fullness. Data were segmented into head tilt and waist tilt time periods and IMU signals compared to O_2Hb signal. **Results:** Motion artifacts during both head and waist tilt activities for all participants (n=11) were visually detected in fNIRS and NIRS O_2Hb signals (Fig 1). Waist tilt resulted in head motion for all cases, while head tilts mainly affected the head IMU. Our previously published motion detection algorithm identified sudden IMU vector changes, segmented out motion-affected portions, and sliced the remaining signal achieving 100% detection accuracy, p=<0.001.
Conclusion: An IMU-based signal motion isolation algorithm effectively identifies and corrects head and waist tilt artifacts NIRS/fNIRS signals. This enables consistent detection of blood flow changes in the bladder and brain during filling.

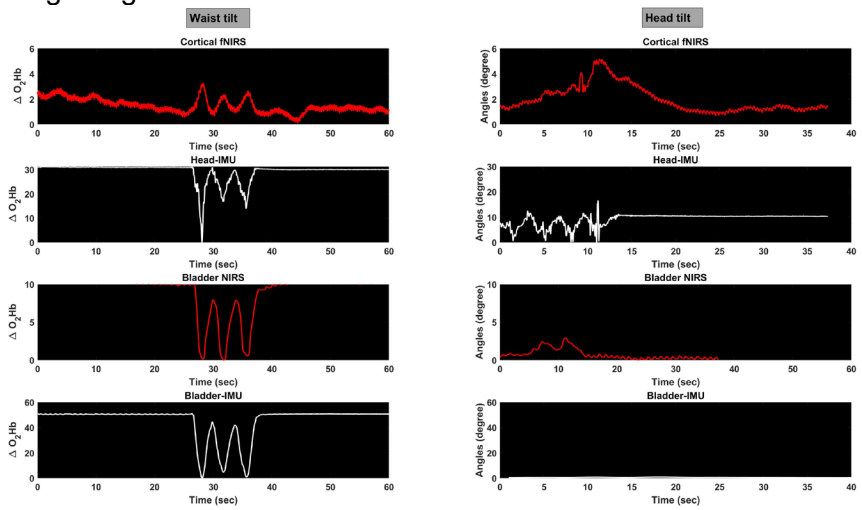

Figure 1. O_2Hb signals (red tracings) and corresponding IMU recordings (white tracings) during waist tilt (left column) and head tilt (right column) activities from a single participant. Both the NIRS and fNIRS signals demonstrate visual correlation with experimentally induced motion. For the waist tilt activity (left column), both the head and bladder IMUs show robust motion detection. However, for the head-tilt activity (right column), motion detection is more isolated to the head IMU (note difference in bladder IMU scale).

Research Areas: Overactive Bladder (OAB), Uroimaging, Innovative technologies

P-05

Stone fragmentation enhancement using a variable beam shape electrohydraulic lithotripter

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Introduction/Objective: Kidney stone movement due to respiration is one of the main reasons for poor outcomes in shock wave lithotripsy (SWL) treatment for nephrolithiasis. We have developed an electrohydraulic lithotripter that can also generate an elongated beam to address excursion from the focus while minimizing kidney tissue exposure and improving fragmentation. **Methods:** Shock waves were generated from multiple transducers mounted on an 8.1" spherical carrier (bowl). Each of these transducers were made from 105 pins and 3D printed from titanium (Fig). This arrangement was then encased in a hard setting epoxy and polished such that only the pin tips are exposed. A ground electrode mesh was placed 10 mm away from the pin tips. The bowl was filled with an electrolyte, which in our case was saline. This was part of the apparatus was acoustically linked with a freshwater tank using a silicone rubber membrane (Fig. 1). To ensure stable performance, the saline is chilled, degassed and recirculated using a pump. Two transducer groups on the bowl are connected using toggle switches to a 16 kV power supply. To generate a conventional circular shaped beam, the first group of 36 transducers are energized. Then, to change over to an elongated beam shape, the second group of 36 transducers was activated. Pressure measurement was conducted in the focal plane using a fiber optic hydrophone (FoPH 500, RP Acoustics GmBH) with an average of 5 repeats at each spot at a lower energy setting (13 kV). To test the fragmentation effectiveness, a 6 mm cylindrical Begostone™ phantom was placed in a 15 mm diameter cylindrical cavity filled with tap water made of tissue mimicking rubber. The phantom was cast from 5 parts of Begostone™ powder and 2 parts of water, and air dried for 24 hours. It was pre-soaked in water for at least 20 mins before the treatment and the phantom was placed at the focal point. Then, to simulate stone motion due to respiration, the stone holder cavity was shifted by 5 mm and 10 mm from the focal point. Stone comminution was evaluated at each of these locations after administering 250 shock pulses at 0.3 Hz, using both beam shapes. The fragments were air dried and sieved. The proportion of fragments under 2 mm was taken to be the stone comminution value. **Results**: The pressures measured on the focal plane for both beam shapes are shown in Fig. 1. Their -6 *dB* beam widths were identified as 12x12 mm and 10x16 mm. Stone comminution was found to be 43.6 ± 4.4%, 43.1 ± 5.5% for the symmetric and elongated beams at the focus. But, at the 5 mm off-focal position, these numbers were 25.2 ± 8.1%, 36.4 ± 6.7% respectively, and at 10 mm, they were 16.9 ± 6.1% and 23.4 ± 8.7%. A photograph of the resulting fragments and the comparative bar plots are shown in Fig 1. The increase in performance at the off-focal locations is about 50%, which is significant considering our baseline circular beam is at least 50% broader than that of a typical clinical lithotripter. By eventually making the entire transducer array fully addressable, we plan to enable continuous correction to beam shape and size in response to feedback from ultrasound imaging. ML and AI tools would aid us in identifying the best beam shape for each stone presentation enabling seamless efficiency enhancements.

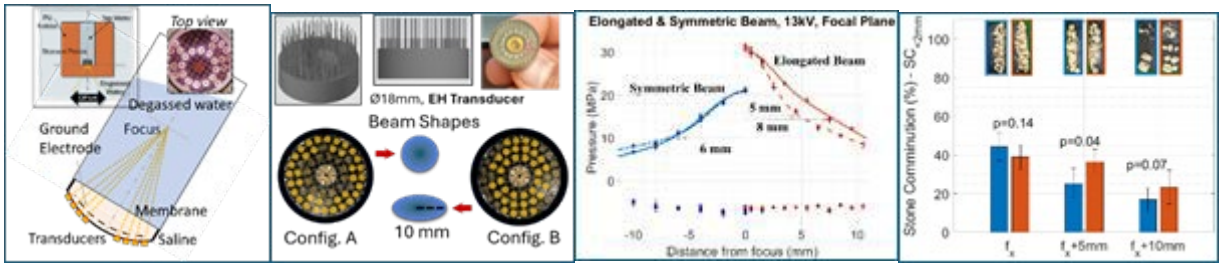

Figure 1: (L-R) The bowl on which transducers are mounted. A 3D schematic rendering of the transducer, and the transducer groups that are activated to produce a symmetric or an elongated beam. The pressure map on the focal plane for the symmetric and elongated beam used to obtain the beam sizes. Stone comminution results for both beam types compared.

Conclusion: The use of an elongated beam resulted in a 50% improvement in stone comminution performance showing promise for an improved SWL procedure in the future.

Research Areas: Nephrolithiasis, Machine Learning

P-06
Computational modeling of sacral nerve stimulation for treatment of overactive bladder

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Introduction: Overactive bladder is a debilitating condition that affects 16.0% of men and 16.9% of women in the U.S. When medication fails to treat symptoms, sacral nerve stimulation (SNS) has proven to be an effective and safe treatment option, with up to 90% of patients seeing >50% symptom improvement. While SNS has been in use since FDA approval in 1999, an understanding of the underlying mechanisms is lacking, and (re)programming of stimulation parameters is often a trial-and-error process.
Methods: We constructed a computational model of the pelvis and third sacral nerve root (S3) (Figure 1A) to quantify nerve fiber activation from SNS. We used publicly available segmentations to model the pelvic organs and published histology of S3 to sweep a three-dimensional nerve through the sacral foramen; we modeled the Medtronic InterStim™ lead alongside S3. We used this finite element model to solve for the electric potentials in the tissues. Using NEURON, we calculated the response of biophysical fiber models (Figure 1B) within S3 to different combinations of active electrode contacts while varying lead positioning. Finally, we designed novel leads that enable selective activation of fiber populations in S3.

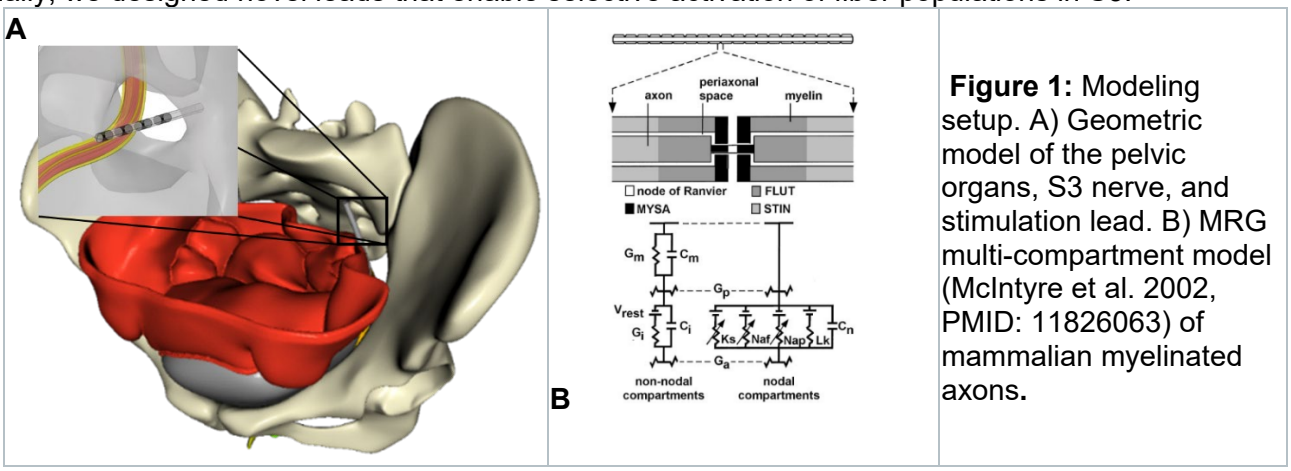

Figure 1: Modeling setup. A) Geometric model of the pelvic organs, S3 nerve, and stimulation lead. B) MRG multi-compartment model (McIntyre et al. 2002, PMID: 11826063) of mammalian myelinated axons.

Results: Lead positioning had a strong effect on activation thresholds of S3 fibers; responses varied the most when the lead was moved or rotated lateromedially. Closely spaced bipolar configurations required the highest amplitude to activate S3 fibers, followed by monopolar stimulation, and highly spaced bipolar configurations had the lowest required amplitude. Different sacrum geometries and nerve paths changed the overall excitability but not the relative excitability of fibers within S3. Our novel lead designs enabled the activation of S3 at lower stimulation amplitudes than the standard clinical lead while enabling greater control over the nerve fiber populations activated by stimulation.
Conclusion: This study presents the first computational model of SNS incorporating both pelvic organs and sacral nerve geometry derived from histology and provides an innovative tool for understanding and improving SNS treatment. Our findings highlight the critical role of lead placement and configuration, offering potential opportunities for enhancing SNS efficacy and patient responsiveness. Our novel lead designs have the potential to provide fine control over the effects of SNS. Future research should focus on developing novel leads for clinical testing, as well as patient-specific modeling of SNS to examine and improve therapeutic outcomes.

Research Area: Overactive Bladder, Neurourology, Innovative technologies

P-07
Implementing Ambient AI Software in the Outpatient Urologic Practice

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Introduction/Objective(s): Ambient artificial intelligence (AI) exists in the intersection between context-aware AI (use of real-world data) and ambient intelligence (processing sensor input) to produce clinical documentation by summarizing the conversation held between a physician and patient without the need for explicit dictation. We sought to examine how the clinical implementation of an ambient AI tool may help to reduce physician workload by easing the burden of documentation.
Methods: A prospective cohort analysis was conducted on five urologists across various subspecialties who used a combination of Nuance DAX or Abridge, two ambient AI documentation tools, during clinical encounters. The Ambient AI tools recorded the patient-provider interaction and summarized the encounter into a standard progress note template within the Epic electronic health record (EHR). Epic Integrated Signal Software was utilized to assess documentation efficiency metrics. Following a two-week “training” period, efficiency metrics from five consecutive weeks post-implementation were compared to five consecutive baseline weeks prior to software implementation. The primary efficiency metric was time in notes per appointment, with secondary outcomes including EHR usage outside scheduled hours, “pajama time” (7 PM – 7 AM), and chart closure within 1 business day of appointment. Following implementation, physicians completed a non-validated questionnaire on the perceived benefits of ambient AI use in their clinical practice. Paired t-test statistical analysis was performed for continuous variables.
Results: A total of 1081 unique encounters occurred over our trial period, 509 pre- vs. 572 post-implementation. Results revealed no change in mean time spent in notes per appointment, (8.36 min vs. 8.16 min, p=0.886) after implementation of ambient AI software. We found significantly decreased mean time spent in the EHR outside scheduled hours per day (39.6 min vs. 26.4 min, p=0.0015). Chart closures within 1 business day of the initial encounter improved with ambient AI, but did not meet significance (77.2% vs 89.7%, p=0.38). Overall, 4 of 5 physicians felt the AI software to be beneficial in improving workflow on post-implementation questionnaire.
Conclusion(s): Ambient AI implementation significantly reduced time spent in the EHR outside scheduled hours in this small cohort, suggesting potential benefits in reducing clinician workload. Though reductions in documentation time and chart closure time were not statistically significant, observed trends indicate possible workflow improvements. Further studies with broader adoption are needed to confirm these effects, while also evaluating the impact on quality of care and clinician burnout.

Research Areas: Artificial Intelligence, Nephrolithiasis, Quality Improvement

P-08

Experimental and Modeling Analysis of Heat Transfer in Laser Lithotripsy: Correlating Bubble Dynamics and Irrigation Flow with Temperature Distribution

Junqin Chen PhD, Chuan-Hua Chen PhD, Pei Zhong PhD

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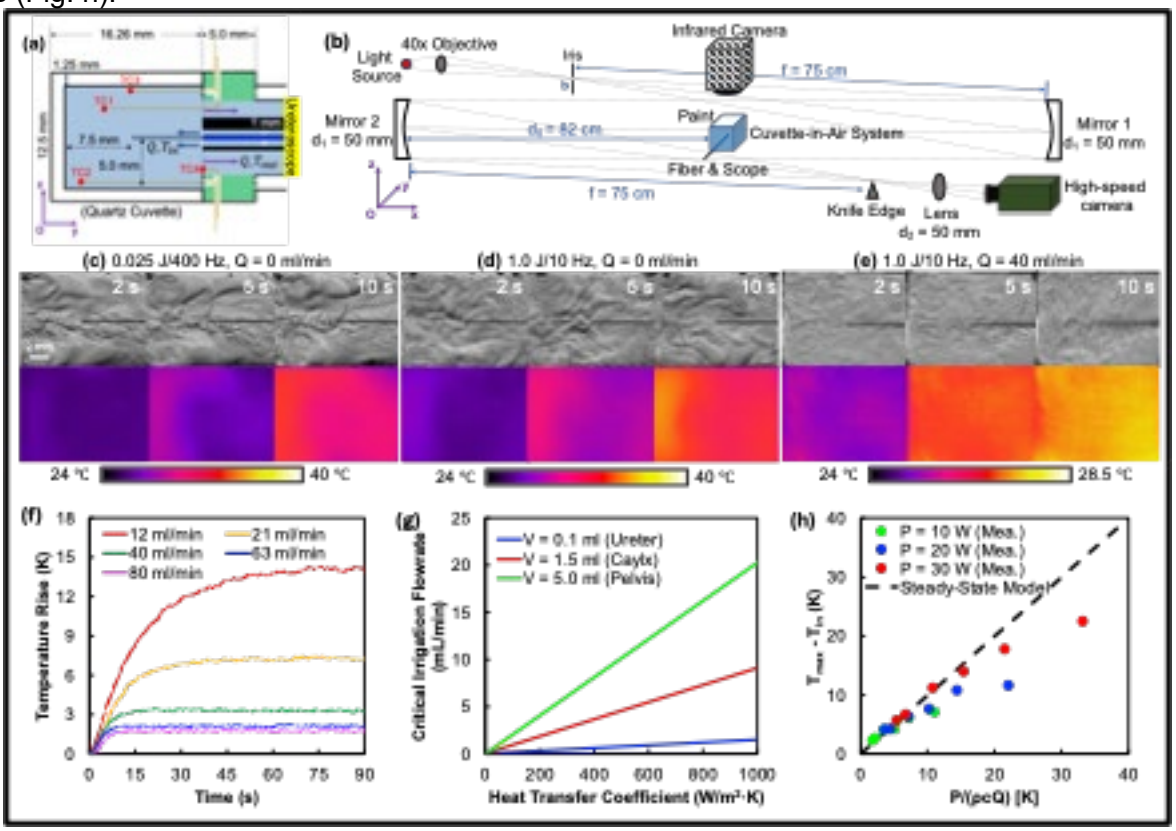
Introduction: Laser lithotripsy (LL) is a primary treatment for urinary stones, but the risk of thermal injury, particularly with the thulium fiber laser (TFL), remains a concern. This study investigates the heat transfer mechanisms in LL and develops a predictive model to prevent thermal tissue injury under different procedural conditions.

Methods: Experiments using a cuvette-in-air system simulated TFL treatment in a renal calyx (Fig.a). High-speed schlieren imaging captured convective flow induced by laser-generated bubbles, while infrared imaging and thermocouple measurements quantified temperature distributions along the tissue wall and within the fluid (Fig. b). Key parameters, including laser power (P), pulse energy (E_p), frequency (F), and irrigation flow (Q), were systematically varied to assess their effects on heat accumulation. A steady-state energy balance model was developed to predict maximum fluid temperature during LL: $T_{max}=T_{in}+P/(\rho cQ)$, where T_{in} is irrigation temperature, ρ is water density, and c is specific heat.

Results: Bubble-induced convection primarily drives heat transport from the fiber tip to the tissue boundary. Stronger bubble pulsation at higher E_p enhances temperature homogenization (Fig. c-d), while increased irrigation improves convective cooling and accelerates temperature stabilization (Fig. e-f). Parametric analysis suggests that irrigation-induced convection plays a dominant role in system cooling compared to blood perfusion, particularly at clinical irrigation rates (i.e., Q > 20 ml/min) (Fig. g). The thermal model successfully provides an upper bound for the measured fluid temperatures under various P and Q settings (Fig. h).



Conclusion: Convective heat transfer, driven by bubble dynamics and irrigation flow, is a critical factor in determining the maximum fluid temperature in LL. Both experiments and modeling support a simple yet robust relation correlating temperature rise with laser power, irrigation fluid temperature, and flow rate. The developed model may offer a clinically relevant tool for predicting safe operating conditions in LL.

Research Area: Nephrolithiasis

P-09

Outcome prediction for sacral neuromodulation therapy in women with non-neurogenic urgency incontinence: A machine learning approach

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Introduction: Treatment selection for urgency urinary incontinence (UUI) follows guidelines that lack patient-specific treatment criteria. Our objective was to develop models aimed at predicting outcomes following sacral neuromodulation (SNM) therapy in women with UUI.

Methods: Our models used data from the ROSETTA trial that compared sacral neuromodulation to 200U Botox for women with UUI who were non-responsive to medication. We employed regularized linear regression models to predict 1) the change in UUI episodes after the first-stage lead placement (FSLP), and before internal pulse generator (IPG) and 2) the monthly median change in UUI episodes over 6 months post treatment. We explored the use of baseline disease specific questionnaires, bladder diaries, clinical history, and urodynamics as candidate predictors for both models. For the 6-month model we examined the impact of adding 2-week post-FSLP bladder diary variables, to determine if adding these variables improved model performance. Quantification, via bootstrapped train/test splits, included adjusted R-squared (R2) and mean absolute error (MAE).

Results: 162 subjects were included in the FSLP model. 145 subjects received an implant (89%), of whom 140 subjects were included in the 6-month model, excluding those with fewer than 4 (out of 6) diaries either due to missing data, stimulator removal, or off protocol therapy.

Urodynamic parameters failed to increase performance in initial models and thus were not used. The total number of baseline incontinence episodes contributed to the largest increase in R2 for both final models. Final models adjusted for baseline bladder diaries and clinical history.

The FSLP model had a MAE of 1.02 episodes [0.81, 1.25] (95% CI) and R2 of 0.48. The 6-month model, without Stage I diary variables, had a MAE of 1.16 episodes [0.94,1.35] and R2 of 0.38. The addition of 2-week diary variables had minimal impact, decreasing MAE to 1.09 episodes [0.78,1.37] and increasing R2 to 0.39.

Conclusion: These models may be useful for advising women undergoing sacral neuromodulation UUI regarding expected therapeutic efficacy. Although the models offer improved accuracy compared to average results (MAE of 1.52 episodes), they need to be validated in another cohort. In addition, the models may be improved from additional physiologic data (e.g., measurements of urethral function) as well as improved signal processing techniques applied to raw urodynamic data.

Research Areas: Artificial Intelligence, Data Science / Predictive Analytics, Overactive Bladder (OAB)

P-10

Development of a low-cost, reliable catheter for urethral pressure profile in anesthetized rats

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Introduction: Clinically the Urethral Pressure Profile (UPP) is a valuable tool for diagnosing and assessing urethral dysfunction but is rarely studied in animal models due to costly equipment. This study aims to develop an inexpensive, reliable method for recording UPP in rats.
Methods: Female CD rats (n=16) were anesthetized with urethane (1.2 g/kg, SC). UPP recordings were compared between a custom side-hole catheter (3 Fr, Braintree Scientific, $40) and a solid-state pressure catheter (2 Fr, Millar, ~$3500). A custom puller was created to withdraw the catheter at a fixed rate.
To assess the impact of infusion rate 15 different rates (0.1–38 ml/hr) were tested in 3 rats. Each rate was tested 3x in pseudo-random order. For each infusion rate the maximum urethral pressure (MUP) was calculated.
To evaluate the consistency of the side-hole catheter compared to the solid-state catheter, back-to-back recordings were performed on 4 rats, with approximately 20 pulls from each. The same puller speed and infusion rate was maintained across all trials. For all possible group's sizes, we randomly selected trials and calculated the average MUP from the selected trials. This random sampling process was repeated multiple times per group size and the proportion of average MUPs that were close to the average MUP (within 10%) across all trials was calculated.
UPPs were measured using both catheters before and after administering additional urethane to the animals (0.3 g/kg, n=9) to assess the impact of increased anesthesia.
Results: The side-hole catheter showed a rapid increase in MUP from 0.1 to 10 ml/hr, followed by a slower increase from 10 to 38 ml/hr. The side-hole catheter had 90% of its random trial groupings within 10% of the final MUP in 4 trials or less, whereas the solid-state catheter required between 6 and 10 (varied by experiment). Contrary to expectations only the Millar catheter showed a reduction in MUP following administration of additional urethane anesthesia; the side-hole catheter did not.
Conclusions: Our side-hole catheter successfully records UPPs comparable to those obtained with a solid-state transducer. While the side-hole catheter produces slightly higher average pressures, it demonstrates greater consistency. However, it failed to show the reduction in MUP observed with the solid-state transducer. We verified that a 12 ml/hr infusion rate works well in young rats, but this verification did not account for the older rats used in our study on the impact of additional anesthesia. To draw meaningful conclusions, we plan to expand our dataset and perform comparative analyses based on strain and age. Future work will focus on further validating the side-hole catheter's utility in assessing changes in urethral function.

Researcher Areas: Urodynamics

P-11

Association between bladder shape and detrusor overactivity in ultrasound urodynamics

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Introduction/Objective: Invasive urodynamics (**UDS**) is the current gold standard for diagnosing detrusor overactivity (**DO**). Gray et al. (Ultrasound, 2019) found increased bladder sphericity in individuals with DO **(DO+)** compared to those without **(DO-)**. To determine if transverse plane bladder shape demonstrates more circularity in DO+ individuals than DO- individuals, this study used transabdominal ultrasound during UDS studies.

Methods: This prospective study included women indicated for UDS who were divided into DO+ and DO- groups based on UDS analysis. Continuous transverse abdominal ultrasound images were acquired during UDS. Images for DO+ group were chosen during involuntary contraction. Images for the DO- group were chosen at volume-matched points during filling. Bladder walls were manually traced and circularity was quantified using ImageJ circularity function (**Figure 1**). Infused volumes which correspond to images and participant demographics were recorded.

Results: 18 DO- and 9 DO+ participants were identified and volume-matched images were compared. Mean bladder circularity for the DO+ group (0.90±0.01) was significantly greater than for the DO- group (0.86±01, $p<0.05$). Compared to a threshold of 0.867 (Fisher's exact, $p<0.05$), 8/9 (89%) participants in the DO+ group and 7/11 (39%) in the DO- group had values greater than threshold. There was no significant difference between volumes corresponding to the images, age, and BMI for the DO+ and DO- groups (321 vs 319 ml, 69 vs 57 years, 27.4 vs 28.5 kg/m^2, respectively, $p>0.05$).

Conclusion: This study shows that DO+ individuals have bladders with greater circularity than DO- individuals, suggesting that bladders in individuals with DO have greater contractile tone during filling. These results indicate that ultrasound imaging could be a non-invasive screening and/or diagnostic tool for DO.

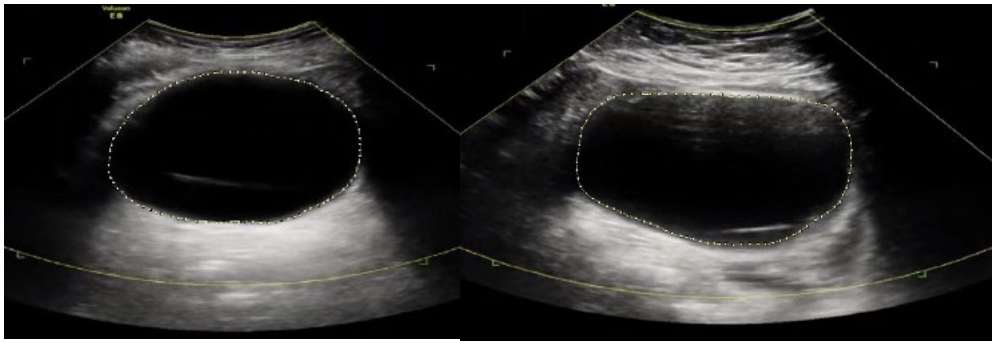

Figure 1: Bladder ultrasound images for A) DO+ individual and B) DO- individual with differences in circularity.

Research Areas: Overactive Bladder (OAB), Innovative Technologies, Uroradiology

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Disclosure: Drs. Klausner & Speich have ownership interest in Vesi Corporation, a startup company that may benefit from the results of this study.

P-12

Exploring the relationship between Nocturia and Major Adverse Cardiovascular Events (MACE): A Bayesian Analysis

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Introduction: Nocturia is a common lower urinary tract symptom that significantly impacts quality of life. Mixed evidence suggests that the presence of nocturia (based on coding variables) may be associated with major adverse cardiovascular events (MACE). However, such studies are limited by the accuracy of coding. Therefore, the objective of this study is to better understand the association between nocturia (quantified by volumes and episodes on bladder diaries) and MACE.

Methods: From 2021-2024, the Lower Urinary Tract Network (LURN 2) observational study enrolled participants with urinary urgency. LURN 2 data was extracted and collated with the electronic medical records (EMR) for MACE outcomes (all-cause mortality, cardiac death, cardiac bypass, percutaneous coronary intervention, acute coronary syndrome, congestive heart failure, and hospitalization) since LURN 2 enrollment. Baseline demographics, patient-reported outcomes, medical history, bladder diary data were collected from the LURN 2 dataset and MACE outcomes were collected from the EMR . Those with a diagnosis of a MACE outcome prior to LURN 2 enrollment were excluded. The primary outcome was to investigate an association between number of nocturia events on bladder diaries and ranked MACE outcomes. Secondary outcomes were to investigate an association between volume of nighttime urine production and nocturnal polyuria index (NPI or proportion of daily urine made at night) and ranked MACE outcomes. Analysis was completed using Bayesian proportional odds ordinal model with skeptical priors. Model predictors include nocturia-related variable, age, sex, diuretic use, and obstructive sleep apnea (OSA).

Results: Of the 146 participants, 10.3% developed a MACE diagnosis. Mean follow-up time was 28.5 (+/- 9.9) months. The mean age was 66.0 years (+/- 13.5) years with a mean BMI of 29.8 (+/- 8.6) kg/m2. 17.1% had diabetes mellitus, 44.5% had hypertension, 24% had OSA, and 75.3% used diuretics. The median of nocturia episodes was 1 (0.5,2), and mean nocturia volume was 473.2 (+/- 461.3) milliliters. A positive effect between variables was defined as adjusted OR >1. The median cumulative adjusted odds ratio of the nocturia episodes was 0.94 (95% credible interval (CI) (0.6,1.5), demonstrating a 41% probability of a positive effect. Similarly, the median cumulative adjusted odds ratio of nocturia volume was 0.98 (95% CI 0.9, 1.0), yielding a 22% posterior probability of a positive effect on MACEs. Lastly, the aOR of the effect of NPI on MACE outcomes was 1.01 (95% CI 0.98, 1.03), revealing a 74% posterior probability of a positive effect.

Conclusion: Our findings suggest that increasing nocturia episodes and voided volumes slightly elevate the risk of development of MACEs, but there is a higher probability that NPI has more of an impact on cardiovascular health. Thus, careful quantification of nocturia and NPI using bladder diaries could be beneficial in evaluating future MACE risk.

Research Areas: Overactive bladder (OAB)

P-13

Non-Invasive Ultrasound Detection of Bladder Wall Micromotion Changes Before and After Detrusor Overactivity Events

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Introduction/Objective: Overactive bladder (OAB) is a prevalent condition characterized by urinary urgency and often associated with detrusor overactivity (DO), a condition in which involuntary bladder contractions occur. The gold standard for assessing DO is invasive urodynamic testing, which places catheters inside the bladder to measure pressure fluctuations. However, this method is uncomfortable and carries risks such as urinary tract infections. Emerging evidence suggests that bladder wall micromotion (BWM)—small rhythmic contractions of the bladder—plays a role in OAB and may be detected non-invasively using ultrasound displacement (UD) imaging. This study investigates the relationship between DO events and UD patterns, aiming to determine whether micromotion characteristics change before and after a DO event. The objective of this study was to assess bladder wall micromotion using ultrasound displacement imaging and determine how DO events influence micromotion frequency and pattern tightness.

Methods: Anatomical M-mode ultrasound cine-loops of the bladder were obtained from OAB patients during indicated UD testing. OAB was characterized by the ICIq-OAB and OABV3 surveys. Ultrasound imaging was acquired at approximately 50% cystometric capacity (based on a pre-study void diary). A custom texture correlation algorithm was developed to track temporal changes in bladder wall thickness across consecutive ultrasound frames. Fast Fourier Transform (FFT) analysis was applied to extract micromotion frequency components from different time segments relative to DO events.

Results: Among the 26 patients analyzed, 8 (30.8%) were confirmed to have detrusor overactivity (DO) based on blinded interpretation from an expert urologist and urogynecologist. The remaining 18 were classified as non-DO. FFT peaks for micromotion range (1-7 cycles per minute) were higher after DO (0.47± 0.1,$n=4$) , compared to before DO (0.15±0.06,$n=4$) and no DO detected (0.05±0.08,$n=16$, $p>0.05$).

Conclusion: This study presents a novel, non-invasive approach for assessing bladder wall micromotion in OAB patients. The observed changes in micromotion frequency before and after DO events suggest that DO itself may create a resonance effect that enhances micromotion synchronization. Ultrasound UD could potentially serve as a non-invasive adjunct to traditional urodynamic testing. However, futures studies are required to validate these findings in larger cohorts and exploring potential clinical applications for real-time OAB diagnostics.

Research Areas: Overactive Bladder, Urodynamics.

P-14

Nocturia and falls associations among Lower Urinary Tract Network cohort

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Introduction: Nocturia, defined as nighttime awakening to void during the main sleep period, is a common lower urinary tract symptom. Nocturia is hypothesized to impact the risk of falls due to low lighting during urgency episodes and poor sleep, which affect balance throughout the day. The objective of this study is to evaluate the association between nocturia and fall outcomes, including injury and severity of injury.
Methods: This was a secondary analysis of care-seeking participants with lower urinary tract symptoms in the Lower Urinary Tract Network (LURN 2) observational cohort from 2021 - 2024. Baseline demographics, medical history, patient-reported outcomes, and bladder diary data were also collected from the LURN 2 dataset. Updated demographic, medical history, and fall outcomes were abstracted from electronic medical records (EMR). Those with a previous history of falls before enrollment in LURN 2 were excluded. Bayesian logistic and ordinal regression models with skeptical priors were fit to assess the association between nocturia episodes and fall-related outcomes (absence/presence of injury, number of falls, and ranked injury severity). Model variables included nocturia-related variables, age, visual impairment, arthritis, diuretic use, and obstructive sleep apnea (OSA).
Results: Among the 121 participants included, 21.5% experienced at least one fall. The mean (+/-SD) follow-up time was 29.7 (+/- 9.8) months. The mean participant age was 62.7 (+/-13.4) years and BMI was 30.4 (+/- 8.37) kg/m^2. The median (IQR) number of nocturia episodes was 2 (1,3) episodes and the mean nighttime volume was 719 (+/- 606) milliliters. Those who fell were generally older (67.6 vs. 62.2 years) and had a higher BMI (33.2 vs. 29.9 kg/m2). For this analysis, non-trivial effect was defined as adjusted OR of >1.2. The median adjusted cumulative odds ratio is 1.001 (95% credible interval (CI), 0.6, 1.5) for the effect of nocturia episodes on falls, yielding a posterior probability of a non-trivial effect of 21%. Diagnoses of arthritis and OSA demonstrated a strong non-trivial effect on falls with aOR of 2.7, (95% CI 0.98, 7.0) and aOR of 3.0, (95% CI 1.1, 2.7), demonstrating posterior probabilities of 95% and 95%, respectively. Similarly, the median adjusted cumulative odds ratio is 0.97 (95% CI 0.5, 1.8) for the effect of nocturia episodes on injury, demonstrating posterior probabilities of a non-trivial effect of 25%. There is a 16% posterior probability of a non-trivial effect of number of nocturia episodes and severity of injury (aOR 0.92, 95% CI 0.5, 1.6).
Conclusion: A 21% probability exists of a non-trivial effect of number of nocturia episodes and falls. Similarly, there is a 25% probability of a non-trivial effect of nocturia episodes and presence of injury. Our findings emphasize the concern for falls and injury due to nocturia. Providers may want to screen for nocturia and provide management strategies to prevent unnecessary injuries.

Research Areas: Voiding dysfunction/urinary retention, Other

P-15

Ageing causes a significant reduction in the number of C-fibers in the mouse bladder independent of senescence

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Introduction: Ageing is associated with a decrease in somatosensory awareness in the lower urinary tract. Within the mouse bladder, sensory information is relayed, in part, by a network of small unmyelinated c-fibers that intercalate in and just below the urothelia layers. In this study we investigate the hypothesis that ageing is associated with a reduction and/or alteration in the morphology of this network which might reduce the viscerosensation relayed to the central nervous system. In addition, cellular senescence can contribute to nerve loss during aging so we sought to investigate a role for senescence in promoting any potential changes to the c-fiber network. For this we have developed a novel method for 3-dimension analysis of the c-fiber network.

Methods: Male C57Bk6/J mice were analyzed at 3 (young) and 22 (aged) months. Aged mice were treated of Dasatinib (5 mg/kg) and Quercetin (50 mg/kg) or vehicle by oral gavage every two weeks for five consecutive days with this cycle repeated 4 times. Bladders were removed, cut neck to dome on one side, pinned to a paraffin tray and fixed with 4% paraformaldehyde for 2 h before storage in 70% ethanol. For staining, sections were washed (PBS/1% triton X-100), blocked overnight and incubated with rabbit anti-Calcitonin Gene Related Peptide (CGRP) (Sigma) (a marker of c-fibers) for 3 days. Sections were washed and further incubated with goat anti-rabbit IgG (H+L) conjugated to Alexa Flour 594 overnight. Sections were thoroughly washed and mounted to slides in custom-made chambers (8.3 mil deep). Two non-overlapping areas in the lower third of the bladder were imaged (Leica Stellaris 8 confocal) as 10 µm z-stacks (1 µm per slice) with the 20X objective. File were imported into Imaris Image Analysis Software and individual filaments drawn manually in 3D using the Filament Tracer wizard. Filament information (number, length and branches) were then exported and analyzed by GraphPad Instat (ANOVA and Student-Newman-Keuls). Significance was indicated by $p<0.05$.

Results: There was a significant decrease in the number of c-fibers in the aged mice compared to the young. Surprisingly, there was an associated increase in average filament length in the bladder of the aged mouse, but no significant changes in branching were found. Bladders from animals treated with the senolytics had c-fiber numbers, lengths and branching not statistically different from the aged mice.

Conclusion: Ageing reduced c-fiber number in the bladder while increasing length. These effects were not driven by senescence.

Research area: Diabetes, Neurourology, Bladder Inflammation

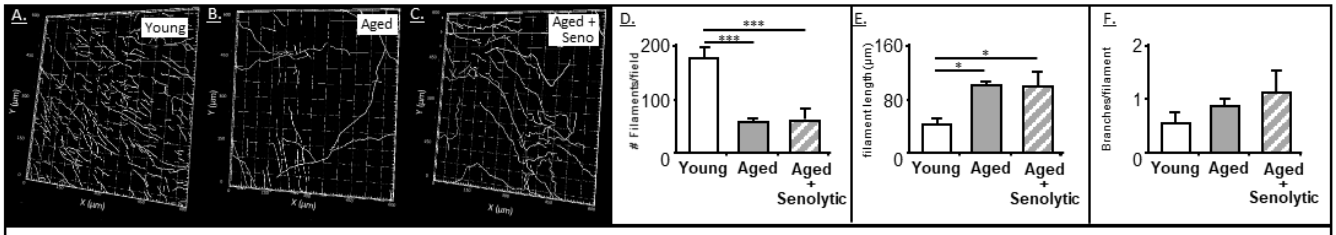

Figure 1. 3D assay of c-fibers in young, aged and aged mice treated with senolytics. A-C. Representative filament maps from young (A), aged (B) and aged + senolytic (C) mice prepared in Imaris using z-stacks from confocal microscopy. D-E. Summary graphs of the 3 groups showing the number of filaments per field (D.), the average filament length (E.) and average number of branches per filament (F). N=3, 5 and 4 respectively. *p<0.05, ***p<0.001 by ANOVA and Student-Newman-Keuls.

P-16

Effects of conus medullaris stimulation persist without stimulation: a case study in a patient with traumatic spinal cord injury

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Introduction: Spinal cord stimulation (SCS) has emerged as a treatment for pain and functional recovery in patients with spinal cord injury (SCI). In particular, conus medullaris stimulation has shown promise for improving bladder dysfunction, yet its therapeutic potential remains understudied. This case report examines the impact of conus medullaris stimulation in a patient with incomplete SCI who previously had minimal functional improvement with thoracic SCS.

Methods: A 37-year-old male with incomplete SCI following multiple gunshot wounds presented with neuropathic pain, motor and sensory deficits, and bowel and bladder dysfunction. After three years of limited response to thoracic SCS, an SCS electrode over the conus medullaris, which was implanted at the index operation, was activated for the first time. Motor, sensory, and autonomic function were assessed over a year following stimulation.

Results: Following conus medullaris stimulation, the patient experienced significant improvements in bladder function, progressing from intermittent self-catheterization to independent voiding without urinary tract infections. Motor function improved, with increased hip and knee flexion strength. Sensory function expanded to include temperature sensation at the L4 level. These functional gains remained stable even during stimulation holidays up to one month, suggesting remodeling of spinal circuits.

Conclusion: This case highlights the potential of conus medullaris stimulation to promote neuroplasticity and restore bladder, motor, and sensory function in SCI patients. The sustained improvements despite stimulation holidays suggest lasting circuit changes. Further research is warranted to elucidate the mechanisms and broader applicability of conus stimulation in SCI rehabilitation.

P-17

Necroptosis of Schwann cells is responsible for the diabetic decrease in efferent neurotransmitter release in bladder smooth muscle in male Akita mice

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Introduction: Diabetic bladder dysfunction (DBD) is the most common diabetic complication and it manifests as bladder overactivity or underactivity. In the Akita model (type 1) we have shown that males develop underactivity due to a decrease in efferent neurotransmitter release. Retraction of the nerve axon/terminal is well-known in diabetic peripheral neuropathy and new studies suggest that it is due to necroptosis, a programmed form of necrosis, in Schwann cells. Thus, our overarching hypothesis is that necroptosis of Schwann cells in the bladder leads to retraction of acetylcholinergic nerve axons/terminals from the detrusor and a decrease in neurotransmitter release which causes underactive bladder. We have investigated this hypothesis by pharmacologically inhibiting necroptosis with Necrostatin-1 and assessing detrusor contraction in response to electrical field stimulation, which releases efferent neurotransmitters. We have also assessed Schwann cell density and their association with a marker of necroptosis.
Methods: Male Akita develop hyperglycemia at 4-5 weeks. Beginning at 6 weeks, mice were given Necrostatin-1 (1.65 mg/kg/day, i.p.) or vehicle until 15 weeks, when bladder underactivity is normally manifest. At 15 weeks urothelium-free detrusor strips were assessed by myography**.** Separate bladders underwent immunocytochemistry and quantitation for myelin (Schwann cells) or were co-stained for MLKL, a marker of necroptosis.
Results: Nondiabetic bladder strips show frequency-dependent increases in contraction while diabetic mice demonstrate a decrease in this force. However, when given Necrostatin-1, the force of contraction was not significantly different from non-diabetic controls, suggesting necroptosis was critical to development of this phenotype. Myelin density (i.e. Schwann cells) was significantly decreased in cross sections of diabetic bladders, which was prevented with Necrostatin-1, suggesting a necroptotic loss of Schwann cells with this disease. Further, we show that diabetes causes a significant increase in Schwann cell co-localization with MLKL, a marker of necroptosis, which was also prevented by Necrostatin-1.
Conclusion: Diabetes in male Akita decreases neurotransmitter-mediated detrusor contraction and Schwann cell myelination in the bladder. Inhibition of necroptosis prevents these changes.

Research area: Diabetes, Neurourology, Bladder Inflammation

P-18

Evaluating Neuropathic Pain, Neurological Function, and Urodynamic Outcomes in Patients with Thoracic Spinal Cord Injury: A Single-Blinded, Controlled, Clinical Trial Evaluating the Feasibility of Dual-Lead Spinal Cord Stimulation

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Introduction and Objectives: Traumatic thoracic spinal cord injury (SCI) frequently results in chronic neuropathic pain, motor and sensory deficits, and urological and bowel dysfunction. While prior observational studies have shown the potential benefits of spinal cord stimulation (SCS) for these sequelae, its impact on objective urodynamic outcomes and bowel assessments remains under-explored. This NIH-funded clinical trial aims to evaluate the feasibility of dual-lead (thoracic and conus medullaris) SCS not only in reducing neuropathic pain and enhancing neurological function but also in improving bladder and bowel function, as determined by detailed urodynamic and anorectal evaluations.

Methods: This single-blinded, two-arm parallel clinical trial will enroll patients with chronic neuropathic pain following thoracic SCI. Exclusion criteria include complete cord injury, inability to participate in assessments, and significant psychiatric or infectious co-morbidities. Participants will be randomized in a 1:1 ratio to either active SCS (“on”) or sham stimulation (“off”) for 3 months, followed by a one-way crossover. The primary outcome is the change in the pain impact score on the Multidimensional Pain Inventory (MPI-SCI) at 3 months relative to baseline. Secondary outcomes include changes in electrophysiological measures (electromyography amplitudes), motor and sensory American Spinal Injury Association (ASIA) Impairment Scores, and functional status via the Spinal Cord Independence Measure (SCIM). In addition, our expanded urodynamic evaluation will assess bladder function using cystometry (to measure bladder capacity, detrusor overactivity, and leak point pressures), uroflowmetry, and post-void residual measurements. For bowel assessment, patients will maintain bowel diaries and undergo anorectal manometry, providing objective data on sphincter function and rectal compliance. These assessments are informed by outcome measures that have demonstrated improvements in urodynamic parameters result in enhanced patient satisfaction and quality of life.

Expected Results: It is anticipated that active SCS will lead to statistically significant improvements in MPI-SCI pain impact scores, motor and sensory ASIA scores, SCIM ratings, and patient-reported outcomes (e.g., VAS and PGIC). Moreover, enhanced urodynamic profiles—including increased bladder capacity, reduced detrusor overactivity, lower post-void residuals, and improved uroflowmetry parameters—are expected. Improvements in anorectal manometry and bowel diary records are also anticipated in the SCS “on” group, particularly with extended stimulation duration (evaluated at 3, 6, 9, and 12 months).

Conclusion: Dual-lead SCS may serve as a safe and effective treatment modality for patients with SCI experiencing neuropathic pain, neurological deficits, and urological/bowel dysfunction. By incorporating comprehensive urodynamic and anorectal testing, this trial seeks to provide robust, objective evidence that SCS not only improves subjective pain and motor outcomes but also enhances bladder and bowel function, thus offering a more integrated approach to SCI rehabilitation.

Research Areas: Neurourology, Urodynamics, Voiding Dysfunction/Urinary Retention

P-19

Outcomes and Quality of Life Following Rectourethral Fistula Repair: A 27 Year Experience

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Introduction/Objectives: Rectourethral fistula (RUFs) are complex genitourinary abnormalities that present significant diagnostic and therapeutic challenges. While surgical repair has been the well-established treatment, the impact of diverse repair techniques on the quality of life and surgical outcomes of patients remains underexplored.

Methods: This study examined non-radiated patients who underwent RUF repair using the York Mason technique between January 1996 and July 2023. Data regarding demographics, follow up data, including short form-12 (SF-12) questionaries administered pre and post operatively, were collected. Post surgical outcomes at 30- and 90-days were reviewed. Statistical analyses were conducted to assess the data distribution. The interquartile range (IQR) was calculated to measure the data variability and summarize the spread of the central 50% of values.

Our multidisciplinary algorithm was implemented in 2012. Patients with fistulas <2 cm and without history of radiation therapy underwent York-Mason repair, whereas those with fistulas 2-3 cm or with prior irradiation underwent transperineal repair with gracilis flap interposition. Those with nonrepairable fistulas (>3 cm or fixed tissues) underwent pelvic exenteration. Before repair, the algorithm recommended all patients to undergo urinary and bowel diversion.

Results: A total of 107 patients with RUFs were identified: 75 received repairs and 30 underwent pelvic exenteration. Patients who underwent York Mason repair were examined (27/107, 26%). Patient median age at surgery was 66 (60-68) years and BMI was 29 (26-30). Prior to repair, the median rectal fistula size was 1.5cm and urethral fistula was 1 cm. The most common etiology for RUF was rectal injury (26%). The post repair length of stay was 2 days (2-3). Most common complications were: A total of 17 patients (26%) achieved fistula closure within a median of 3 weeks (Table 1). The most common complication was abscess formation. Patients were seen to have an improvement in their SF -12 quality of life scores after York Mason repair.

Conclusion: The adoption of a multidisciplinary approach for surgical management in an algorithmic fashion improved York Mason patient post-surgical outcomes and quality of life scores for patients.

Tables 1-3. Demographics, Surgical Complications, and SF-12 Quality of Life Score for patients who underwent York Mason RUF Repair.

Non Radiated York Mason Repair	
Demographic Characteristics	
Age	66 (60-69)
BMI	29 (26-31)
DM	3
COPD	1
Smoker	10
PY	8
CHF	0
CAD	5
PVD	1
Afib	1
Mean Fistula Size, Rectal (cm)	1.5 (1-1.5)
Mean Fistula Size Urethral (cm)	1 (0)

Complications (n=10)	
Ileus	1
SBO	1
Wound Dehiscence	2
Abscess Collection	2
Drain placement	1
Cellulitis	1
OR takeback	1
Re-admission	1
TPN	1

Quality of Life Scores	Physical Composite Score	Mental Composite Score
Exent Pre-operative	22.76	50.61
Exent Post-operative	32.99	58.4

Research Area: Urinary Reconstruction, Clinical Outcomes, Fistula

P-20

Efficacy of antibiotic prophylaxis in children with vesicoureteral reflux: meta-analysis of published results of randomized clinical trials

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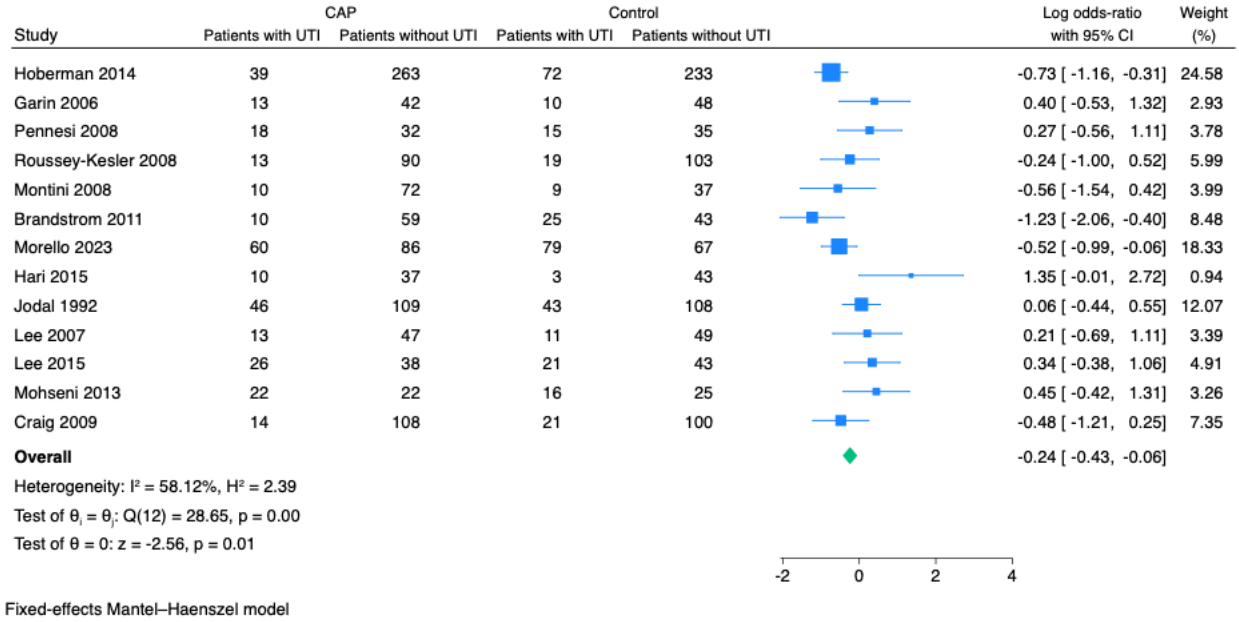
Introduction/Objective(s): Controversy and variability in treatment continues to remain regarding continuous antibiotic prophylaxis (CAP) for vesicoureteral reflux (VUR) management. A prior meta-analysis in 2015 of clinical trials published to date demonstrated that CAP significantly reduced the risk of febrile and symptomatic urinary tract infections (UTI) compared to no treatment or placebo. The results of the Antibiotic Prophylaxis and Renal Damage in Congenital Abnormalities of the Kidney and Urinary Tract (PREDICT) trial was recently published in September 2023. We sought to determine whether the updated evidence continues to support the use of CAP in children with VUR.

Methods: We searched MEDLINE, EMBASE, Google Scholar, and Web of Science Core Collection electronic databases for all trials published of this topic. The study protocol was prospectively registered at PROSPERO (No. CRD42024587765). Reports were assessed and data abstracted by two independent reviewers, with differences resolved by consensus. Risk of bias was assessed using standardized instruments.

Results: We identified 2,603 studies, of which 13 were included in the meta-analysis. Pooled results demonstrated that CAP did significantly reduce the risk of UTI (pooled OR 0.79, 95% CI 0.65-0.94, p = 0.01). In cases of UTI, there was an increased risk of antibiotic resistance in the CAP group (pooled OR 6.96, 95% CI 4.35-11.02). There was no difference in the rates of new renal scarring between groups (pooled OR 1.06, 95% CI 0.78-1.45). Substantial heterogeneity existed between studies with I^2 58.12%. A subgroup analysis, stratified by each study's susceptibility to bias, demonstrated that studies at lower risk of bias had a stronger protective effect from CAP (pooled OR: 0.54, 95% CI 0.41-0.71).

Figure 1: Forest plot summarizing the results of a meta-analysis comparing continuous antibiotic prophylaxis (CAP) versus control for preventing urinary tract infections (UTIs) in children with vesicoureteral reflux (VUR).



Conclusion(s): Compared to placebo, no treatment, or probiotics, CAP did significantly reduce the risk of recurrent UTIs. CAP did increase the risk of antibiotic resistance but did not affect rates of new renal scarring.

Research Areas: Infections of the urinary tract, Pediatric Urology

P-21

Procedural pain and choice of anesthetic at time of polyacrylamide hydrogel injections for stress urinary incontinence: a randomized controlled trial

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INTRODUCTION/OBJECTIVE: Urethral bulking with polyacrylamide hydrogel (PAHG) is an FDA-approved treatment for stress urinary incontinence (SUI) due to intrinsic sphincter deficiency (ISD). While manufacturer-provided instructions recommend placement of intra-urethral anesthetic gel and/or injection of local anesthesia into the paraurethral tissues prior to injection, there is no evidence guiding preferential use of either method and no studies have assessed how procedural anesthesia may affect the efficacy of PAHG injection, need for post-procedure catheterization or rate of PAHG re-injection. Although limited data supports the use of topical anesthesia for other in-office urogynecologic procedures, prior studies have not compared anesthetic methods for pain control. The objective of this study was to compare patient-reported pain scores between control (the use of topical anesthetics and paraurethral block) versus experimental (topical anesthetics alone) cohorts in women undergoing PAHG injection for treatment of SUI and/or ISD.
METHODS: This single-blinded randomized controlled trial included adult women without chronic pain conditions undergoing PAHG injection in the outpatient clinic setting of a single academic institution from 09/2023 to 08/2024. Participants were randomized to one of two anesthetic protocols: 1) control (external topical lidocaine plus prilocaine (EMLA) cream, intraurethral topical lidocaine gel, and lidocaine paraurethral block) or 2) experimental (external topical EMLA cream and intraurethral topical lidocaine gel alone). Participants were blinded to their randomization through a mock injection protocol. Pre- and post-procedural pain scores were measured using a 10-point visual analog scale (VAS). Patients unable to void post-procedure underwent catheterization with a 10-French straight catheter to remove half of bladder contents before reattempt. If still unable to void, a 12-French indwelling catheter was placed. Secondary outcomes included International Consultation on Incontinence Questionnaire–Urinary Incontinence (ICIQ-UI) scores and Patient Global Impression of Improvement (PGI-I) scores for SUI. Using pilot study data, a sample size of 52 patients was estimated to detect a difference of 1.5 between cohorts in post-procedure VAS score. A safety endpoint of 3 patients in the experimental arm requiring early termination of the procedure due to pain was set prior to study initiation.
RESULTS: In total, 23 participants were enrolled (see Table 1 for participant characteristics). The study was stopped early due to meeting of the pre-defined safety endpoint. No patients in the control arm required early termination. The mean post-procedural VAS score was 4.5 ± 2.7 for the control arm versus 7.4 ± 2.3 for the experimental arm ($p = 0.002$). For the three patients requiring early termination of the procedure, mean procedure-associated VAS scores were reduced from 10.0 ± 0.0 to 4.0 ± 2.6 following paraurethral block ($p = 0.04$). There was no difference between the treatment arms with respect to procedure duration, need for PAHG re-injection, ICIQ-UI score at 2- and 12-weeks post-procedure, or PGI-I score for SUI at 2- and 12-weeks post-procedure. Participants in the experimental arm were more likely to require straight catheterization to facilitate voiding in-office (33.3% vs 0%; $p = 0.035$) with no difference in home catheterization.
CONCLUSION: This study presents compelling data to support the use of a paraurethral block in conjunction with topical anesthetics at time of PAHG injection.

RESEARCH AREAS: Female pelvic medicine

P-22

Development of a novel natural orifice thermoregulatory device for the treatment of chronic pelvic pain

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Introduction/Objective(s): Chronic Pelvic Pain (CPP) is a challenging disease process stemming from conditions including endometriosis (EM), vulvodynia, pelvic inflammatory disease (PID), interstitial cystitis/bladder pain syndrome (IC/BPS), and prostatitis. CPP significantly impacts sexual health, quality of life (QoL), and can result in potential self-harm. It burdens patients, families, and caregivers, accounting for 20% of the $635 billion chronic pain expenses. In the United States, 15% of women of childbearing age (nearly 10 million women) are affected by CPP. Globally, CPP affects 1 in 5 women and 1 in 12 men, highlighting the urgent need for safe, non-addictive pain management solutions. Cryoanalgesia has been previously described as a modality for management of perineal pain for patients with chronic perineal pain. Our objective is to create a device that can help in the alleviation of pelvic pain through natural orifice temperature cycling.

Methods: Using a non-implantable, radiometric and thermal sensor equipped probe we set out to measure depth of tissue impact of temperature cycles in a porcine animal model after obtaining IACUC approval. The animals were anesthetized and a midline laparotomy incision made. Thermal regulating sensors were sutured in place in the spaces posterior to the rectum, anterior to the rectum and posterior to the vagina in females (bladder in males), anterior to the vagina and posterior to the bladder in females, and anterior to the bladder. Suprapubic tubes were inserted along with temperature sensors in the bladders. The probe was inserted vaginally or rectally, and temperature monitoring of the tissues and bladder was conducted with temperature cycling. At the completion of data collection, the animal was euthanized and rectal, vaginal, and bladder tissue were collected for pathologic evaluation.

Results: Studies were completed on 5 porcine models. Tissue perfusion and temperature regulation demonstrated a depth of penetration of approximately 30mm. Pathologic specimens were obtained following the completion of the thermal data gathering. Final pathology results and aggregate data for temperature cycling are pending and will be available in time for presentation.

Conclusion(s): Thermal cycling using a natural orifice intraluminal probe has been safely demonstrated in porcine models. Initial data suggests it should have adequate depth to provide analgesic effects on sensory nerve fibers within the pelvis. Future research will need to be conducted via phase 2 trials to determine safety in humans.

P-23

Peritoneal Fluid Protects Against Ferroptosis Induced by Lipid Control Agents. by Lipid Control Agents

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Introduction/Objective(s): Endometriosis is a chronic condition which causes ectopic growth of endometrial lining outside the uterus. This condition affects 10-15% of women aged 15-49 and causes up to 50% of women with endometriosis experience infertility, making it a significant concern for women of reproductive age. As the causes and molecular mechanisms underlying endometriosis remain incompletely understood, current treatment options are limited to surgery, hormonal therapies, and analgesics. Recent studies have identified the role of ferroptosis in endometriosis, a type of cell death linked to the presence of excessive iron and lipid metabolism. This study seeks to investigate various ferroptosis inducers and lipid control agents for their potential therapeutic values in treatment of endometriosis. As a major component of the endometriosis environment, the peritoneal fluid was also studied for its effects on the ferroptosis of endometriosis cells.

Methods: Human endometrial stromal cells (HESCs) derived from endometriosis patients and the human endometriosis epithelial cell line (HEECs, 12Z) were used in cell viability analysis after cells were treated with ferroptosis inducer erastin and lipid control agents, omega-3 and omega-5, using CellTiter cell viability MTS assay kit. Ascites from patients with cirrhosis and peritoneal fluids from rats was also tested for their effects on ferroptosis in HESCs, HEECs, and 12Z cells. RNA was extracted using a Stat-60 Kit from the 12Z cells after treatment with erastin and omega-3 as well their combination with ascites. The RNA samples will be used for RNA sequencing analysis. The endometriosis mouse model using 10-week-old C57BL/6J mice was created using surgical transplantation of endometrial tissues from the same strain donor mice.

Results: We have determined the ferroptosis inducer Erastin reduces endometrial cell growth in both endometrial stromal cells and endometriosis epithelial cells, suggesting the potential for ferroptosis involvement in treatment of endometriosis. We also demonstrated that peritoneal fluid and ascites are effective to protect endometriosis from ferroptosis, suggesting their influence in treatment. Recently, we have also found that fatty acids such as omega-3 and omega-5 were effective for induction of endometriosis ferroptosis, suggesting their potential as therapeutic drugs to treat the condition. Treatment of the endometrial cell line 12Z with varying concentrations of these free fatty acids has determined that omega–3 was significantly more effective than omega-5 at killing these cells. More studies will be conducted to detect whether the omega-3 fatty acid and other antilipidemic drugs may contribute to reversal of ascites-associated ferroptosis protection. RT-PCR will also be performed to assess for the presence of ferroptosis markers including SLC7A11, CHAC1, and GPX4. To further investigate the gene regulation during cell ferroptosis along with protective effects of ascites, RNA sequencing will be performed using the cells under ferroptosis induction and ascites treatment. The treatment potentials will be studied in vivo using the mouse model we have established.

Conclusion: Peritoneal fluid demonstrates protection of endometrial lesions from ferroptosis, but may be susceptible to antilipidemic drug treatment. The future direction of this study will be development of antilipidemic drugs which are able to reverse the ferroptosis protection caused by peritoneal fluids.

Research Area: Female Pelvic Medicine

P-24

Cxcl17 Alters urinary function but does not affect foam cell formation in the mouse prostate

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Introduction/Objectives: Benign Prostatic Hyperplasia (BPH) is a multifactorial disease characterized by the non-malignant enlargement of the prostate gland, leading to urethral compression and lower urinary tract symptoms (LUTS). LUTS impairs quality of life due to difficulties in storing and voiding urine. Previous research by our team has demonstrated that inducing BPH in mice via a steroid hormone imbalance increases the number of prostatic macrophages and initiates their translocation into the luminal space, where they differentiate into lipid-rich foam cells. These foam cells express chemokines that could promote fibrosis, proliferation, angiogenesis, and inflammation. We identified the chemoattractant, *Cxcl17*, as a potential driver of this macrophage migration within the disease model. Therefore, we hypothesized that the epithelial cytokine, *Cxcl17*, facilitates the translocation of macrophages into the lumen and the formation of foam cells, driving the development of BPH pathology and urinary dysfunction. This hypothesis was evaluated through via generating steroid hormone imbalance in *Cxcl17*-deficient mice.
Methods: Cxcl17-knockout (KO) mice (B6;129S5-Cxcl17tm1Lex/Mmucd, The Jackson Laboratory) were obtained and bred and wild-type (WT) littermates were used as controls. Mice underwent subcutaneous implantation of testosterone and estradiol for two, six, or twelve weeks, or they received sham surgery. Urinary function was evaluated using the Mouse Urovoid system measuring urine flow rate, average mass, total mass, and voiding frequency. Prostate lobes were collected and analyzed using immunohistochemistry to assess immune cell types staining for CD45. Oil Red O staining was used for foam cell identification. Bladder size and volume were also assessed.
Results: *Cxcl17*-KO T+E2 mice exhibited a higher number of voiding events, whereas WT T+E2 mice showed an increase in average voiding mass at week 4, but no other timepoints showed significant difference. *Cxcl17*-loss did not affect prostate weight, bladder weight, and bladder volume. Additionally, Oil Red O staining identified lipid droplets and foam cell formation in the ventral prostate, with no significant differences between genotypes. Interestingly, CD45-positive cells were significantly reduced by T+E2-treatment in the dorsal prostate lobe of *Cxcl17*-KO mice.
Conclusion: These findings suggest that the loss of *Cxcl17* slightly alters urinary function in the T+E2 BPH mouse model. The absence of significant differences in prostate weight, bladder weight, and bladder volume suggests that *Cxcl17* deficiency does not impact overall prostate enlargement. Most importantly, foam cell formation was not influenced by *Cxcl17*-loss, which might suggest that Cxcl17 has no role in macrophage infiltration or an alternative chemoattractant compensated for this effect. Taken together, these results highlight the complex interaction between macrophages, epithelial chemokines, and urinary dysfunction in BPH, suggesting compensatory mechanisms may preserve immune infiltration and disease progression without *Cxcl17*.

Research Areas: Benign Prostatic Hyperplasia/Voiding Dysfunction and Urinary Retention

P-25

Electronic Cigarettes Induce Morphological Changes of the Mouse Penis Concomitant with Erectile Dysfunction

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Introduction/Objectives: The present study aimed to examine if electronic (e) cigarettes increase the risk of erectile dysfunction (ED), a highly prevalent male sexual condition reported to occur in 52% of men in the US. E-cigarettes are battery-powered devices which aerosolize an inhaled viscous liquid containing nicotine, vegetable glycerin (VG), propylene glycol (PG) and artificial flavoring. Traditional cigarettes are a known cause of ED, although it is unclear whether the same is true for e-cigarettes. Abnormal smooth muscle (SM) distribution relative to collagen in the corpus cavernosum (CC), the primary erectile tissue within the penis, is a known indicator for ED. Therefore, analysis of CC morphology was performed on e-cigarette exposed male mice.

Methods: 24 C57BL/6J mice (11-16 weeks old) were divided into three groups and exposed to commercial flavored e-cigarette vapor (24 mg/mL nicotine; 60:40 VG:PG) (n = 8), base liquid vapor (60:40 VG:PG) (n = 8), or ambient air (sham control) (n = 8) for 3 hours daily, 5 days/week for 8 weeks in Scireq InExpose® whole exposure chambers. Mouse penis shafts were fixed, processed, sectioned and stained with Masson's Trichrome to differentiate the internal tissue of the CC that was quantified with Aivia AI Image Analysis Software to produce a SM/collagen ratio. Testes and seminal vesicle (SMV) weights were also recorded and normalized to body weight. Statistical analyses were performed with GraphPad Prism 9.

Results: Mice exposed to the commercial e-cigarette vapor exhibited significantly reduced SM/collagen ratios in the CC (0.0685 ± 0.0064 vs. 0.1000 ± 0.0084). Normalized testes weights were significantly increased in the commercial e-cigarette exposed mice compared to the base liquid and sham controls (0.0036 ± 0.0001 vs. 0.0037 ± 0.0001 and 0.0032 ± 0.0001, respectively). Normalized SMV weight in the commercial e-cigarette mice was also significantly increased compared to sham controls (0.0105 ± 0.0003 vs. 0.0091 ± 0.0005) (Table 1).

Table 1: Statistical comparisons of CC SM /collagen ratio and normalized testes and SMV weights with e-cigarette exposures. [a]: commercial e-cigarette to sham, [b]: base liquid to sham, [c]: commercial e-cigarette to base liquid

	Commercial E-cig	**Base Liquid**	**Sham**	
	24 mg nicotine, 60:40 VG:PG, flavorings	60:40 VG:PG	Air	**P-value**
CC SM to collagen ratio	0.0685 ± 0.0064	0.0862 ± 0.0099	0.1000 ± 0.0084	**0.01[a]**, 0.31[b], 0.15[c]
Testes weight	0.0036 ± 0.0001	0.0037 ± 0.0001	0.0032 ± 0.0001	**0.04[a]**, **0.004[b]**,0.49[c]
SMV weight	0.0105 ± 0.0003	0.0098 ± 0.0003	0.0091 ± 0.0005	**0.03[a]**, 0.25[b], 0.10[c]

Conclusions: Male mice exposed to commercial e-cigarette vapor containing nicotine and artificial flavoring chemicals exhibit reduced smooth muscle levels in the CC and additional abnormalities of the reproductive tract, indicative of ED and consistent with the effects of traditional cigarette smoking. This suggests e-cigarette use is sufficient to cause dysregulation of male sexual organs and continued use should be cautioned.

Research Areas: Sexual Dysfunction, Toxicology/Environmental Health, Infertility

P-26

Prescribing paradigms in genitourinary health: a provider-centric analysis of vaginal estrogen utilization among medicare beneficiaries

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Introduction/Objective: Vaginal estrogen (VE) is widely recognized as a safe and effective treatment for genitourinary syndrome of menopause (GSM), a progressive condition which adversely impacts quality of life in up 70% of postmenopausal women. Despite its efficacy, real-world prescribing practices vary across provider specialties. This study aims to detail VE prescription claims among female Medicare beneficiaries, with an emphasis on the role of different provider groups, in order to identify opportunities for optimizing treatment strategies.

Methods: A retrospective cohort study was conducted using a 20% sample of Medicare fee-for-service research identifiable file data from January 1, 2006, to December 31, 2018. National drug codes covering creams, tablets, and rings were used to identify VE prescriptions. National provider identifiers (NPI) from data between 2014-2017 were used to define provider specialties, categorizing prescribers into gynecology, primary care providers (PCPs), urology, and advanced practice providers (APPs). Descriptive analyses were then used to calculate the prescription claim frequency, beneficiary demographics, and the proportion of providers who prescribe VE.

Results: A total of 696,072 female Medicare beneficiaries (mean age 71 ± 9 years) filled 3.1 million VE prescriptions over 12-year period, representing a 2.4% yearly prescription rate. Of the prescriptions written, 42% were by gynecologists, 31% by PCPs, 10% by APPs, and 8% by urologists. Approximately, 53% of gynecologists prescribed VE annually, compared to 45% of urologists. Compared to women with vulvovaginal symptoms alone, those with multiple GSM symptoms were 3.4 times more likely to receive VE. Geographic variations show that PCPs in the Midwest and South had lower rates of VE prescriptions, whereas gynecologists and urologists in the Northeast and West had greater rates.

Conclusions: This study demonstrates significant differences in prescribing patterns of VE among Medicare providers across specialties. While urologists account for the minority of filled VE prescriptions, close to half of urologists prescribed VE. Despite this, VE remains likely underutilized, with many eligible women experiencing delayed treatment initiation. Future efforts should focus on educating PCPs and APPs, to ensure appropriate patients are being treated in a timely fashion. Addressing these gaps can optimize GSM treatment and highlight opportunities for interdisciplinary collaboration and provider education.

Research Areas: Female Pelvic Medicine, Health Services Research

P-27

Transcriptomic profiling of the mouse hormonal imbalance model of benign prostatic hyperplasia

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Introduction: Benign prostatic hyperplasia (BPH) is a collection of pathological changes in the prostate affecting aging men, triggering lower urinary tract symptoms (LUTS) including voiding and storage dysfunction. Hormonal imbalance between testosterone and estradiol may be an important driving factor in BPH pathogenesis, however, the exact mechanisms by which these hormones promote BPH remain insufficiently understood. While the long-term (12-weeks) T+E2 model has been shown to accelerate BPH in mice, the individual roles of each hormone, and their synergistic contribution to early BPH initiation and immune cell activity have not been explored.
Methods: We utilized testosterone (T), estradiol (E2), or combination of T and E2 (T+E2) pellet implantation in mice for 24 hours. RNA was isolated from the ventral prostate and long-read, direct RNA sequencing was performed (PromethION, Nanopore). Differential gene expression analysis was generated by the EPI2ME software. Genes with logFC > 1 or <-1, and $p < 0.05$ were included in the downstream analysis. To explore the biological properties distinguishing these models, we assessed KEGG and Reactome functional enrichment analysis.
Results: Across all models, transcriptomic profiles of biological replicates (n=3/model) were correlated. Bulk RNA-seq profiles of E2 samples displayed lower similarity to T and T+E2 groups. A total of 659 genes showed significant unique expression in the T+E2 group (in reference to the sham), including 270 upregulated and 389 downregulated genes. T group featured 151 unique upregulated and 243 downregulated genes, while E2 group exhibited 256 unique upregulated and 297 downregulated DEGs. The three groups demonstrated an overlapping of 90 upregulated and 139 downregulated DEGs. PCA analysis demonstrated the prostate tissue samples from T, E2, and T+E2 groups were separated from the control sham group. The T+E2 group showed significantly enriched pathways related to cell cycle (H2bc6, Cenpm, Cdc7), proliferation (Kras, Prkcd, Sphk1), TLR signaling (Cd36, Usp14, Ctsl) and autophagy (Pik3c3, Tuba4a, Map1lc3b), with a broader diversity in pathway enrichment compared to the T and E2 groups. The T group shared some of the proliferation-related pathways with T+E2 but also showed a distinct enrichment for insulin receptor substrate (IRS) signaling (Igf2, Gab1, Igf1r) and SLC-mediated transport (Slc20a2, Slc26a4, Apod) pathways. The E group exhibited enrichment in TP53-mediated metabolic (Ddit4, G6pdx, Rragb) and VEGF signaling (Mapk12) pathways.
Conclusions: The analysis of the RNA seq data highlighted significant enrichment of cell cycle, proliferation, TLR signaling and autophagy-related pathways in the T+E2 group, consistent with known associations with BPH pathogenesis. The IRS and SLC-mediated pathways enriched in the T group align with their roles in metabolic regulation and exacerbating BPH. Similarly, the enriched VEGF signaling in the E group is consistent with its involvement in BPH. These findings provide a biologically relevant transcriptomic signature that reflects the roles of hormonal imbalance in promoting prostate enlargement and BPH pathogenesis. Further bioinformatics analysis of these datasets will help identify specific hormonal pathways driving BPH and novel biomarkers regulating immune cell infiltration and metabolism. These insights will guide the selection of the most appropriate hormonal imbalance model of BPH, which can be used to study potential therapeutic targets.

Research areas: benign prostatic hyperplasia, voiding dysfunction/urinary retention

P-28

Development of a novel prostate organoid model for understanding neurotrophin-mediated mechanisms in BPH

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Introduction/Objective(s): Benign prostate hyperplasia (BPH) is the most common cause of lower urinary tract symptoms in men. Recent studies have associated neurotrophins, a group of growth hormones, with BPH but have not identified any direct link. The aim of the present project was to grow stromal and epithelial prostate cells in vitro to develop an organoid model to study the impact of the neurotrophin nerve growth factor (NGF) on BPH. **Methods**: Primary cultures of rat prostate cells were seeded in non-adherent wells, with media containing testosterone (500 ng/mL) and/or glucose (25 mM) and/or THX-B (5 µg/mL). ELISA tests were used to measure the concentration of NGF, pro-NGF, and the ratio of pro-NGF/NGF. Structure validity was confirmed by immunochemistry (IHC) to mark smoothelin, pancytokeratin, myosin, and CK17. qPCR analysis on structural genes of the cells was performed to assess any significant differences (figure 1). **Results**: qPCR on cell structural genes did not yield any significant differences. Compared to the control group, THX-B increased pro-NGF secretion, both in combination with testosterone and independently. Conversely, high glucose and THX-B together led to significantly lower pro-NGF expression than media containing only high glucose. The ratio of pro-NGF/NGF was significantly lower in media with THX-B and high glucose compared to media with glucose alone. Similarly, in media with testosterone, THX-B, and high glucose, the ratio was lower than in media containing testosterone and glucose alone.

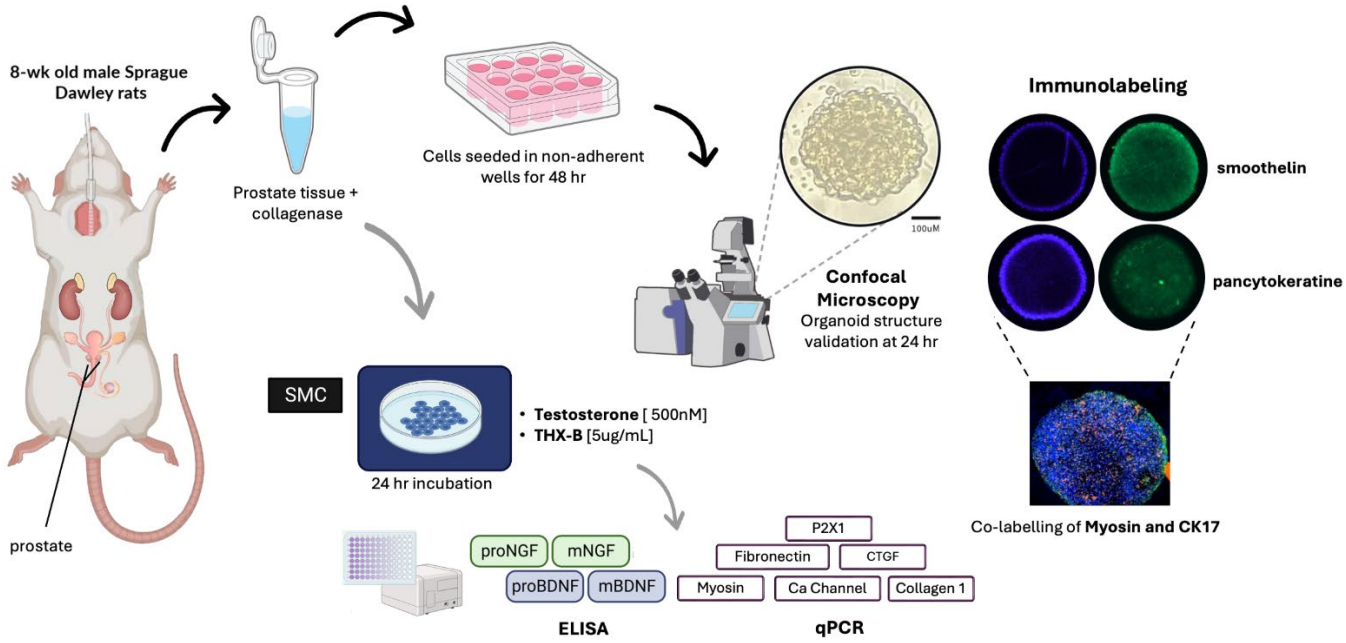

Figure 1: Prostate tissue isolation from 8-week-old Sprague Dawley (SD) rats. Prostate of SD rats were digested by collagenase type II, then seeded in non-adherent wells for 48 hours. The global structure of organoids was examined by light microscopy. Characterization of cell types was performed by IHC using antibodies against myosin (stromal cells) and CK17 (epithelial cells) staining. Cells were cultured in hyperglycemic medium (25 mM) and/or elevated testosterone concentrations (500 nM) to mimic in vitro the conditions of BPH. ELISA kits were used to measure neurotrophin levels. Immunoblotting was performed to assess markers of contractility and fibrosis.

Conclusion(s): Our results demonstrate that (1) organoid culture is reproducible, with stromal and epithelial cells organizing themselves into organoids, and (2) THX-B can influence the production of pro-NGF and lower the pro-NGF ratio in media enriched with glucose or testosterone. This model provides a valuable tool for studying neurotrophin involvement in BPH and may offer insights for future therapeutic interventions.

Research Area: Benign Prostatic Hyperplasia

P-29

Sexual Function in Women with Mullerian Anatomic Differences of the Genitourinary Tract - A Qualitative Evaluation

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Introduction/Objectives: Mullerian anomalies are congenital anomalies of the female reproductive tract. These patients require medical and surgical management specific to their diagnosis and anatomy. Treatment is pursued for various reasons, including obstruction of menstrual flow, infertility, recurrent miscarriages, and sexual dysfunction. Satisfaction with sexual function is an important factor in quality of life and psychosocial well-being Previous studies have found increased levels sex-related anxiety, decreased levels of self-esteem and sexual satisfaction, and dyspareunia in patients with Mullerian anomalies. Despite increased physical and psychological symptoms related to sexual function, there are no standardized tools specific to this population to screen for sexual concerns. The purpose of this project is to design a self-administered sexual function questionnaire specific to patients with congenital Mullerian abnormalities.
Methods: A semi-structured interview guide on sexual function specific to patients with Mullerian anomalies was created using expert input. Next, semi-structured subject interviews will be performed on female-identifying patients with Mullerian anomalies to identify subject concerns and needs. One-on-one interviews will be performed by and NVivo will be used to identify themes from interview transcripts. A questionnaire will then be written that encompasses the themes addressed by subjects.
Results: Results are forthcoming.
Conclusions: It is crucial to better understand the sexual function challenges that patients with mullerian anomalies face so we can better treat primary sexual concerns and complications of treatment. Additionally, creating a specific and validated questionnaire will support further research on mullerian anomalies and their management.

Research Areas: Congenital Urogenital Anomalies/Embryology; Sexual Dysfunction; Female Pelvic Medicine

P-30

Extended Catheterization with Inflatable Penile Prosthesis: No Increased Risk of Erosion, Infection, or Malfunction

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Introduction/Objectives: Much like the approach taken with artificial urinary sphincters (AUS), many Urologic surgeons caution against prolonged catheterization in patients with an indwelling inflatable penile prosthesis (IPP), citing concerns of an increased risk of infection or erosion into the urethra. Despite the frequent coexistence of IPPs and AUSs, there is limited data on the risk of IPP erosion, urethral erosion, or infection following extended catheterization. This study aims to retrospectively assess the incidence of post-operative IPP erosion or infection in patients who had either AUS removal or urethroplasty and then underwent prolonged catheterization.

Materials and Methods: Patients who underwent AUS removal surgery and/or urethroplasty between March 2012 and September 2024 at either Duke Hospital or USC Hospital were identified retrospectively through each institution's electronic health record. Records were reviewed to determine whether these patients had a concurrent IPP at the time of surgery. For those with an IPP, prolonged catheterization after AUS removal was defined as ≥10 days of post-operative catheterization. Charts were then reviewed for IPP-related complications, including erosion, infection, or malfunction following surgery.

Results: Of the patients who underwent either AUS removal surgery and/or urethroplasty, 23 were identified with an IPP at the time of surgery. Mean catheterization time post-operatively was noted to be 31 days. Following prolonged catheterization, 21/23 (~91%) had no IPP related complications within a one-year post-operative period. No patients had complications related to their IPP and catheter. However, 2/23 (~9%) had their IPP removed within one year for reasons not related to urethral trauma, device infection or erosion. Both explants were done secondary to the desire to prioritize AUS durability in the setting of a fragile urethra.

Conclusions: In patients with an IPP following AUS removal or urethroplasty, prolonged catheterization is not associated with urethral or device erosion, infection, or malfunction in the post-operative period of up to one year. IPP safety in the context of prolonged catheterization after AUS removal or urethroplasty may also be applicable to other procedures requiring extended catheterization, such as prostatectomy.

Research Areas: Sexual Dysfunction, Urinary Reconstruction, Voiding Dysfunction/Urinary Retention

P-31

Material Fatigue of the Artificial Urinary Sphincter Pressure Regulating Balloon: A Mechanical and Microscopic Analysis

Matthew Salvino BS[1], Mariela Martinez MD, MS[2], Thomas Schroeder MD[2], Andrew Peterson MD, MPh[2]

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Introduction: The artificial urinary sphincter (AUS) is comprised of a urethral cuff, a mechanical pump, and a pressure regulating balloon (PRB). Material fatigue of the PRB can reduce its ability to generate pressure, leading to recurrent urinary incontinence. This investigation seeks to assess the influence of device age on the mechanical and material properties of PRBs.
Methods: Stress softening and stress relaxation testing was conducted on separate specimens from a subset of 7 PRBs that were evenly distributed in age to mimic habits of daily use. This same subset of 7 PRBs were then analyzed using scanning electron microscopy (SEM). Standard statistical methods were used.
Results: The average age of the PRBs was 7.9 years (0-17.6 years). There was minimal variability in stress softening behavior of the PRB specimens with no significant effect of time during the day on stress ($p = 0.38$). After SEM, 4 of the 7 PRB specimens revealed fine surface cracks present in their microstructure, the 4 oldest specimens in the subset.

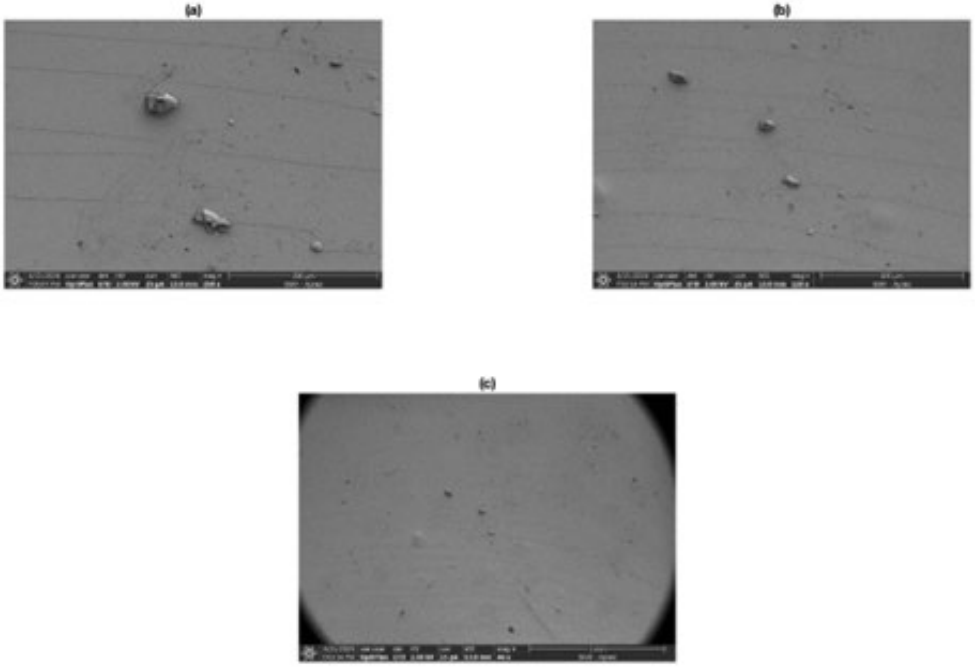

Figure 1. Scanning Electron Microscopy of 17.6-year-old PRB. Significant crack propagation is present in mainly a uniaxial direction. Surface defects and scratches are also visualized. (a) 100μm view. (b) 200μm view. (c) 500μm view.

Conclusion: PRBs do not exhibit stress softening behavior with modeled daily functional use. Older PRBs are more susceptible to developing microstructural defects which can have implications on the functionality and longevity of the PRB. These microstructural defects likely contribute to the loss of mechanical integrity and effectiveness of the AUS in maintaining continence over time. These findings underscore the importance of considering the mechanical properties and mechanical degradation of PRBs in AUS devices.

Research Area: Voiding dysfunction, urinary reconstruction, Artificial urinary sphincter

P-32

Correlation of different pathological features in Benign Prostatic Hyperplasia

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Introduction: Benign Prostatic Hyperplasia (BPH) is one of the most common conditions affecting aging men, characterized by prostate enlargement that leads to lower urinary tract symptoms, which can significantly impact quality of life. BPH is recognized as a multifactorial disease involving cellular proliferation, smooth muscle dysfunction, inflammation, and fibrosis. Our group has identified lipid accumulation as a novel pathological feature in BPH. However, the relationship between lipid metabolism, collagen deposition, and immune cell infiltration in the context of BPH remains unclear. The aim of this study is to explore the interrelationships between these pathological features in order to further understand the underlying mechanisms of BPH.

Methods: Prostate tissue samples were obtained from BPH patients who underwent Holmium Laser Enucleation of the Prostate (HoLEP) surgery (n=47). Fibrosis, indicated by collagen accumulation, was quantified via Picrosirius Red staining and analyzed using fluorescence microscopy. Lipid droplets were detected through Oil Red O staining. Quantification of lipid area and fluorescence intensity was performed using Inform software. These measurements were then correlated with prostate size.

Results: We observed a positive correlation between prostate size and lipid accumulation ($p = 0.0067$). Additionally, lipid accumulation was positively correlated with glandular proportion ($p = 0.0229$), as well as with prostate-specific antigen (PSA) levels ($p < 0.0001$). PSA levels also showed a positive correlation with glandular proportion ($p = 0.0002$), but a negative correlation with collagen accumulation ($p = 0.0147$). Prostate size was positively correlated with glandular proportion ($p = 0.0410$) and negatively correlated with collagen accumulation ($p = 0.0017$). Lastly, collagen accumulation was negatively correlated with both lipid accumulation ($p = 0.0381$) and glandular proportion ($p = 0.0195$).

Conclusions: Our data show several pathological features and their connections, suggesting different phenotypes of BPH. The positive correlation between prostate size and lipid accumulation, along with the negative correlation between lipid accumulation and collagen, indicates that larger prostates tend to have more lipid accumulation and a higher proportion of glandular tissue, while smaller prostates may be more fibrotic and present a stromal-dominant phenotype. PSA levels are strongly linked to both lipid accumulation and glandular proportion. In conclusion, these results highlight the complex interactions within BPH pathology, providing valuable insights into the underlying mechanisms and progression.

Jim Hokanson, PhD
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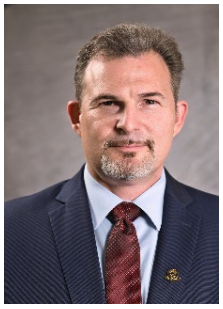
Marquette University and the Medical College of Wisconsin
KURe Alum Scholar

Dr. Hokanson is assistant professor of the Joint Department of Biomedical Engineering at Marquette University and the Medical College of Wisconsin and director of the Pelvic Diagnostics and Therapeutic Laboratory. His research interests include urologic function and dysfunction; electrical stimulation and neuromodulation therapies; signal processing and machine learning; clinical diagnostics; autonomic nervous system and organ physiology; and neural engineering.

Giulia Ippolito, MD, MS
Assistant Professor in Urology
University of Michigan

Dr. Ippolito is a urologist with fellowship training in female pelvic medicine and reconstructive surgery and a health services researcher at the University of Michigan. Dr. Ippolito's clinical focus and practice include evaluating and treating urinary incontinence, neurogenic bladder, female pelvic floor dysfunction and reconstruction of the lower urinary tract, including ureteral obstruction. Her research is focused on understanding and improving decision-making between patients and clinicians, especially in the care of overactive bladder.



Adam Klausner, MD
Professor, Surgery and Urology
Virginia Commonwealth University School of Medicine

Dr. Klausner received his BA from Cornell University and then completed medical school at the State University of New York Upstate Medical University in Syracuse. He then went on to complete a urology residency at Mount Sinai in New York followed by a fellowship at the University of Virginia investigating neurologic and pharmacologic mechanisms of voiding dysfunction. He joined the faculty at Virginia Commonwealth University in 2004 and currently holds the Endeavour Legacy Foundation Distinguished Chair in Urology and serves as the Interim Chair for the newly established VCU Department of Urology. Dr. Klausner developed multi-disciplinary collaborations and leads a research group focused on the development of novel technologies to improve the diagnosis and phenotyping of overactive bladder. Clinically, Dr. Klausner has a busy practice with a niche in the management of neurogenic lower urinary tract dysfunction.
Dr. Klausner's Mechano-Urology lab evaluates biomechanical mechanisms of overactive bladder (OAB) and spontaneous bladder rhythm using animal models and translational urodynamic studies. He and Co-PI, John Speich, professor of Mechanical Engineering, have been funded by the NIH since 2015 and currently have two awards with goals to establish novel ultrasound-urodynamics and to explore the role of Near Infrared Spectroscopy to differentiate brain and bladder influences in OAB. Dr. Linda Burkett, a urogynecologist with training in biomedical engineering joined the team 3 years ago, has an active NIH K-award, and has been focused on the application of Near Infrared Spectroscopy for the assessment of 3rd line OAB treatments.
In addition, Dr. Klausner has played an active role in the Society of Urodynamics, Female Pelvic Medicine, and Urogenital Reconstruction where he was awarded the Paul Zimskind Award for excellence and leadership in voiding dysfunction. He has held leadership roles in the Mid-Atlantic American Urological Society (AUA) where he served as president, and the national AUA where he has served on the core curriculum and judicial and ethics committees and as the co-director for the annual Fundamentals in Urology course. He is highly involved in resident education and has previously served as urology residency program director. .

Aaron Mickle, PhD
Associate Professor, Physiology
Medical College of Wisconsin

Dr. Mickle is an associate professor of physiology at the Medical College of Wisconsin. He leads a research program studying the neuronal mechanism of bladder dysfunction and pain. The group focuses on developing better treatments for bladder disorders such as overactive bladder, bladder pain syndrome, and bladder dysfunction following spinal cord injury. They work on research tool development, implantable biomedicine treatments, and validating new pharmacological targets for treating these diseases.

David Page, PhD
Chair of the Department of Biostatistics and Bioinformatics
Duke University
KURe Advisory Committee

Dr. Page is Chair of the Department of Biostatistics and Bioinformatics at Duke University. He completed his PhD in Computer Science at the University of Illinois at Urbana-Champaign, where his dissertation focused on theoretical aspects of machine learning. He became involved in biomedical applications of machine learning while a postdoc at Oxford University. During his 20 years at the University of Wisconsin-Madison, Dr. Page supervised 17 PhDs and 3 postdocs who went on to become scientists at Google, Amazon, Facebook, Yale, and the Carbone Cancer Center, as well as faculty at Carnegie-Mellon, Catholic University of Leuven, Michigan, Case Western, UCLA, Minnesota State, and Wisconsin. He has also supervised multiple master's students, including now-current PhD students at Duke, Princeton, and MIT.

Susannah Rose, PhD (featured speaker)
Associate Professor, Biomedical Informatics and Health Policy
Vanderbilt University Medical Center (VUMC)

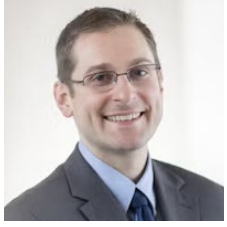
Dr. Rose is an ethicist and a mixed methods researcher specializing in patient experience and the ethics of AI in health care. She is an associate professor at Vanderbilt University Medical Center (VUMC) in the Department of Biomedical Informatics and the Department of Health Policy, and core faculty in the Center for Biomedical Bioethics and Society. Dr. Rose serves as the vice chair of the VUMC Artificial Intelligence Technology Committee that governs AI models within the organization, and she is also the executive director of the AI Discovery and Vigilance to Accelerate INnovation and Clinical Excellence (ADVANCE) Center.

Jonathan C. Routh, MD, MPH, FAAP
Chief, Duke Center for Children's Surgery
Paul H. Sherman Distinguished Associate Professor of Surgery
Associate Professor of Urology, Pediatrics and Population Health Sciences
Duke University School of Medicine
KURe Advisory Committee

Dr. Routh is a pediatric urologist and health services researcher at Duke University School of Medicine, where he serves as the Chief of Children's Surgery and is the Paul H. Sherman Distinguished Associate Professor of Surgery, Pediatrics, and Population Health Sciences. His clinical and research interests include minimally-invasive surgery, complex urologic reconstruction (particularly in children with spina bifida and neurogenic bladder), surgical and non-surgical management of children with disorders of sex development, and pediatric urologic oncology. He is currently an Associate Section Editor for the Journal of Urology, the Chair of the Steering Committee for the Urologic Management to Preserve Initial Renal Function Protocol for Young Children with Spina Bifida (UMPIRE) study, and the co-PI at Duke for both UMPIRE and the National Spina Bifida Patient Registry. Dr. Routh has extensive experience as a mentor and currently serves as a formal mentor for Duke's KURe K12 and the UrogynCREST R25 programs; his list of mentees includes 4 undergraduate students, 10 medical students, 10 urology residents, 2 post-doctoral researchers, and 6 junior faculty members. In addition, he is the Co-Director of the Duke Research Development Course for Trainees.

David Sheyn, MD
Division Director, Female Pelvic Medicine and Reconstructive Surgery at University Hospitals Urology Institute
Director, Clinical Research of the Department of Obstetrics and Gynecology
Associate Professor, Urology and Reproductive Biology
Western Reserve University School of Medicine

Dr. Sheyn is an associate professor of urology and reproductive biology at Case Western Reserve University School of Medicine and serves as the division director of female pelvic medicine and reconstructive surgery at University Hospitals Urology Institute and director of clinical research of the Department of Obstetrics and Gynecology. His clinical expertise encompasses the diagnosis and treatment of pelvic floor disorders, with a specific focus on functional disorders of the bladder. Dr. Sheyn has a robust research portfolio, having published over 100 peer-reviewed articles focusing on the etiology and management of urgency incontinence and overactive bladder and being the recipient of numerous federal and industry-sponsored grants. His work aims to develop a personalized approach to treating pelvic floor disorders through applications of artificial intelligence, big data, genomics and metabolomics. Notably, he has worked on applying AI prediction models for treatment selection and phenotyping of conditions such as overactive bladder, postoperative infections and urinary tract infection. Dr. Sheyn is also a member of the CAIRIBU Machine Learning Interest Group.



Andrew Shoffstall, PhD
Associate Chair, Case School of Engineering
Associate Professor, Department of Biomedical Engineering
Western Reserve University

Dr. Shoffstall is associate chair at the Case School of Engineering at Case Western Reserve University and an associate professor in the Department of Biomedical Engineering. His research interests lie at the intersection of biomaterials and neural engineering with a particular focus on solutions that may readily translate toward an improved neural interface.

Maryrose Sullivan, PhD
Research Health Scientist, VA Boston Healthcare System
Assistant Professor of Surgery, Brigham and Women's Hospital, Harvard
KURe Advisory Committee

Dr. Sullivan's scientific interests have focused primarily on benign disorders of the bladder, including those related to outlet obstruction, diabetes, spinal cord injury and Parkinson's disease. Her research is aimed at uncovering mechanisms responsible for bladder function/dysfunction and urinary incontinence, with the ultimate goal of identifying targetable pathways for intervention and alleviating lower urinary tract symptoms. As a research scientist and biomedical engineer, her research projects exploit a number of multidisciplinary approaches to interrogate these pathways at the cellular, tissue and whole animal levels and include imaging, in vitro, ex vivo, and in vivo techniques. With funding from the Department of Veterans Affairs and NIDDK, she has published numerous original articles, chapters and reviews on topics related to urinary incontinence, bladder contractility, bladder outlet obstruction, neurogenic and non-neurogenic detrusor overactivity, and diabetic bladder dysfunction. She has been fortunate to be involved in mentoring and supervising many urology residents, post-docs, medical students and junior faculty. Dr. Sullivan is also an active member of the AUA, SUFU, SPR and ICS, and is a member of the editorial board of several urology focused journals.

Philip J. Walther, MD, PhD, MBA, FACS
Professor of Surgery/Urology
Associate Professor of Experimental Pathology; Duke University
KURe Advisory Committee

Dr. Walther received his MD-PhD at Duke, his urologic residency at UCLA, an American Cancer Society junior faculty fellowship at Duke; and subsequently an MBA from Duke's Fuqua School of Business (health care management). His lab research interests have been: 1) Developmental GU onco-therapeutics using human xenograft-supported GU tumors (primarily bladder) 2) the genomic elucidation of the role of oncogenic HPV genotypes with lower GU cancers (bladder, penis, and urethra). He served as Chair, GU Surgery Subcommittee of the NIH-funded cooperative study group-CALGB. Dr. Walther was the Site PI at Duke for the first NIH-sponsored multi-institutional study of immune-therapeutics of renal cancer using high-dose interleukin-2, and served as PI of a R21-funded grant to initiate an institutional research program in prostate cancer. He was PI of a VA-based epidemiologic effort with Community Medicine in the study of race-related genomic differences associated with prostate cancer occurrence. Finally, he served on the Study Committee of a 7 year NIH-sponsored nutritional intervention prostate cancer prevention study.

Lenaine Westney, MD
Professor, Department of Urology
University of Texas MD Anderson Cancer Center
KURe Advisory Committee

Dr. O. Lenaine Westney is Professor in the Department of Urology at the University of Texas MD Anderson Cancer Center. Her areas of clinical expertise are postprostatectomy incontinence, neurogenic voiding dysfunction, post-radiation urinary tract reconstruction, and urinary diversion. In her role as the primary urologic reconstructive surgeon in the department, she has emphasized clinical and research collaborations with Colorectal, Gynecologic Oncology and Plastics Surgery with the goal of improving management and outcomes of urinary tract structural and functional disorders in patients with pelvic malignancy. She is certified in Female Pelvic Medicine and Reconstructive Surgery and directs the MDACC Urinary Tract and Pelvic Reconstruction fellowship program. Additionally, Dr. Westney has authored articles and chapters dealing with the management of incontinence in high-risk patient populations. Her current research focuses on the long-term sexual and voiding dysfunction in colorectal cancer patients, the progression of voiding symptoms in hypoestrogenic states, and post-prostatectomy urinary complications. Dr. Westney is an active member of many local, national, and international surgical societies.