

## Understanding Absorbed Radiation Dose in Voiding Cystourethrogram

A new study led by **Rajeev Chaudhry, MD**, assistant professor of Urology in the Division of Pediatric Urology at UPMC Children's Hospital of Pittsburgh, prospectively examined the absorbed radiation dose in pediatric patients undergoing a fluoroscopic voiding cystourethrogram (VCUG).



This is the first study conducted in pediatric patients to measure actual absorbed dose at the level of the skin (sacrum) using dosimetry.

"Most of the literature studies and estimates of radiation exposure in

pediatric patients undergoing fluoroscopic VCUG use either dose area product (DAP) or air kerma as a proxy for absorbed dose. These methodologies give an understanding of the exposure to the patient, but not an accurate measure of the actual amount of radiation absorbed at skin level," says Dr. Chaudhry.

### Study Overview

VCUG has been the gold-standard test for diagnosing cases of vesicoureteral reflux, and as an investigatory diagnostic for assessing genitourinary abnormalities, hydronephrosis, and the function of the posterior urethral valve, among others.

Given the sensitivity of young children to ionizing radiation (10 times more sensitive than adults), and given the stochastic nature of radiation exposure and the potential cumulative burden and consequent increases in risk for malignancy, having as accurate a measure as possible of the absorbed radiation dose from VCUG in pediatric patients is paramount to help guide clinical practice and counsel families of young children.

"While there are other imaging modalities being deployed more frequently as substitutes for or adjuncts to VCUG — for example MAG-3 scans and contrast-enhanced ultrasonography — these diagnostic modalities at present are either not widely adopted and available, and in some instances also introduce a dose of radiation. Given the relative ease and wide-spread use of fluoroscopic VCUG, our goal with this study was to arm clinicians and patients with the most accurate information possible about the radiation exposure from the test," says Dr. Chaudhry.

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## Robotic Surgery Program Updates from the Division of Pediatric Urology at UPMC Children's

The Division of Pediatric Urology at UPMC Children's has more than a decade of robotic-assisted surgical experience for a wide variety of indications. Since 2010, when the Division first began performing robotic-assisted surgery, more than 700 cases of pediatric urologic surgery with robotic assistance have been performed at UPMC Children's.

In March, the Division deployed the newest generation of da Vinci robotic system — the Xi® system — in its operating suite, upgrading its technology from the older Si model of the system.



“We have conducted more than 708 robotic cases in our Division since we first began using a robotic platform, and we have learned a tremendous amount about the advantages of the system and the indications for its use. But, perhaps

more so, we have learned when robotic procedures may not be the optimal surgical path for our patients,” says **Glenn M. Cannon, MD**, Division chief of Pediatric Urology at UPMC Children's. “Our long and diverse robotic surgical experience helps us to better plan our surgeries and select our patients that can benefit the most from the approach.”

Dr. Cannon and his colleagues' surgical experience with the new version of the robot to date have shown a number of advantages for patients. For example, patient docking times with the new system have been greatly reduced.

“While our teams were efficient with patient docking using the previous model, we increased that efficiency greatly. This translates into further reductions in operating time which directly benefits the patient in a number of ways, for example, in anesthesia exposure time, but the decrease in docking time helps reduce surgical cost since the biggest driver of that metric is the length of the procedure,” says Dr. Cannon.

The optical quality of the new system is improved with stereoscopic optics providing greater clarity and resolution in the visual field in three dimensions. Instrumentation afforded by the new system includes devices to seal blood vessels more efficiently in procedures with a higher risk of blood loss.

“The youngest patient we have used the new system on to date was four months of age,” says Dr. Cannon. “What we are trying to evaluate and plan for now is optimal port placements and incisions for patients of different ages because of the increased flexibility available to us. Moreover, while we cannot use the smallest 5mm instruments with the new device, the difference in our experience so far is negligible, even with the smallest of patients.”

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# New Study Shows National Outcomes Improvements in Cases of Pediatric Testicular Torsion

Researchers from the UPMC Children’s Hospital of Pittsburgh Division of Pediatric Urology presented their findings of a new study that examined trends in salvage rates for cases of pediatric testicular torsion at the 2021 American Urologic Association annual conference.



The study, led by former Division fellow **Marc Colaco, MD, MBA**, looked at the testicular salvage rates and time to surgery in cases of testicular torsion prior to and after a scored quality metric of time to surgery was introduced by *U.S. News & World Report* in their annual survey of

Best Children’s Hospitals beginning in 2015.

“Testicular torsion is one of the few emergent conditions in pediatric urology. Testicular salvage rate is correlated with how quickly the condition is recognized and the patient has surgery. Time is of the essence in these cases, but you need to have protocols in place to recognize them and react accordingly,” says Dr. Colaco. “We were very interested in understanding how the outside influence of the *U.S. News & World Report* metric influenced hospital policy and management of these cases, and ultimately patient outcomes.”

The research team analyzed national data from the Pediatric Health Information System database for cases of testicular torsion before July 2015, and after that point when the new quality metric was put into use by *U.S. News & World Report*.

Rates of testicular salvage showed an increase from 58.4% prior to the introduction of the metric to 70.9% in the years after its implementation.

“We saw a significant increase in salvage rates after studying the data. We examined other patient, demographic, and hospital factors, but they were consistent in cases before and after the introduction of the quality metric. This bodes well for patients in terms of outcomes, but we feel it also shows the ability of these types of outside influences to drive changes in care management, which is a significant finding,” says Dr. Colaco.

Other contributors to the study from the Division of Pediatric Urology included Division chief **Glenn M. Cannon, MD**; **Janelle Fox, MD, FACS**; **Francis X. Schneck, MD**; and former Division fellow Jeffrey Villanueva, MD. Department of Urology resident Brian Chun, MD, also contributed to the study.

## ABOUT THE DIVISION

The **Division of Pediatric Urology** offers diagnostic evaluation and surgical treatment for children with genitourinary disorders, including ureteropelvic junction obstructions, vesicoureteral reflux, hydro-nephrosis, and other conditions. Currently led by Glenn M. Cannon, MD, the Division supports a robust clinical and research program, as well as offering an accredited two-year fellowship program featuring an active basic science research laboratory experience.

### Faculty and Staff

**Glenn M. Cannon, MD**, Division Chief and Associate Professor of Urology

**Francis X. Schneck, MD**, Clinical Director and Associate Professor of Urology

**Rajeev Chaudhry, MD**, Assistant Professor of Urology

**Janelle Fox, MD, FACS, CSSGB**, Assistant Professor of Urology

**Katharine Carter, PA-C**

**Britne Hindmarch, Practice Manager**

**Alyssa C. Messina, CRNP**

**Victoria Morando, DNP, FNP-BC**

**Kathleen Perich, CRNP**

### Fellows

**Omar Ayyash, MD, MPH**

## Voiding Cystourethrogram *Continued from Page 1*

For this study, single point dosimeters were applied to the patients' (n=44) sacrum. During the VCUG procedures, all patients received the same fluoroscopy settings: low dose and three pulses per second from a distance of 54 cm from the source to the skin. The smallest possible area was used in conjunction with a tightly collimated x-ray beam. Apart from the study, these parameters are part of standard test protocols in place at UPMC Children's for VCUG.

### Key Findings and Clinical Implications

With the fluoroscopic settings employed in this study, image quality was not degraded or compromised, and the absorbed dose at the skin was low for a single VCUG procedure. The median absorbed dose in this patient cohort was 0.32 mGy, which translates to an effective whole-body dose of 0.04 mSv.

"To add context to the absorbed dose findings we found, a typical pelvic x-ray will expose the recipient to around 0.6 mSv. A CT scan is much higher with a range between 4.8 and 8.4 mSv. Ambient background radiation exposure from environmental factors is about 3 mSv a year," says Dr. Chaudhry. "VCUGs at our institution, using our tightly controlled protocols for radiation exposure, afford a

small dose of radiation to patients in a single exposure, while cumulatively the burden would also be low when comparing the absorbed dose to other modalities and against the yearly exposure recommendations from regulatory bodies."

While the study was performed at a single institution with a relatively small patient cohort, the findings are suggestive of and support the safe use of VCUG in pediatric patients while limiting their exposure to the potential toxicities and morbidities of cumulative radiation exposure. Even with the advent of newer imaging modalities, VCUG will likely remain a standard of care. The data uncovered in this study by Dr. Chaudhry and colleagues will help arm pediatric urologists with a more accurate understanding of the potential radiation exposure to their patients.

### Reference

Chaudhry R, Dangle PP, Cannon GM, Schneck FX, Stephany HA. Prospective Evaluation of Radiation Dose With Conventional Fluoroscopic Voiding Cystourethrogram in Pediatric Patients. *J Pediatr Urol.* 2021 Sep 14: S1477-5131. Epub ahead of print.

## Robotic Surgery Program Updates *Continued from Page 2*

### Learnings and Future Directions of Robotic Surgery in Pediatric Urology

One of the challenges of performing robotic surgery in pediatric patients is that the systems are designed for adult patients and adapted for use in children. While this is not optimal — children are not just small adults; you cannot treat them as such medically or surgically — as the saying goes, with study and skill, pediatric urologic surgeons at UPMC Children's have proven that patients can and do benefit from the technology when used with discrimination.

"When we first began robotic-assisted surgeries more than a decade ago, our initial thoughts were that we could apply this technology to virtually any case or indication, but our experience has taught us that is not the case. We choose our cases with those learnings in mind. When we think robotic approaches are the best method for our patients, we pursue them, and they reap the benefits —

minimally invasive, smaller incisions, in some cases shorter procedures," says Dr. Cannon.

### Comparative Studies and Long-Term Case Evaluations

Dr. Cannon is currently tracking surgical metrics on cases performed using the newest generation of the robot to run longitudinal comparative analyses against prior experience to ensure that key performance metrics such as patient docking time and total surgical case times remain stable and improve.

"The goal is to ensure that our quality level remains high and improves, which we think it will as our preliminary case experience has shown and as our total volume increases over the coming years working with the new robotic device," says Dr. Cannon.

# New Biorepository Will Spur Research into Neurogenic Bladder, Renal Function Biomarkers, Urinary Tract Infections, and the Urinary Microbiome in Children With Spina Bifida

A multidisciplinary team of researchers from the Divisions of Pediatric Urology, Pediatric Hospital Medicine, and Pediatric Nephrology at UPMC Children’s Hospital of Pittsburgh has created a new biorepository to collect and analyze urine samples from children with spina bifida who also have neurogenic bladders.

The biorepository will gather urine samples from participants longitudinally for five years for analysis. Children with spina bifida who are under the age of 18 are eligible to participate in the study.

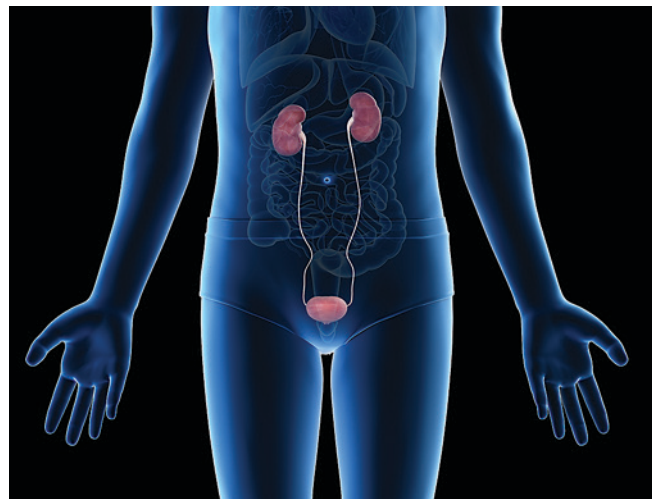


The study’s lead investigator is **Catherine Forster, MD, MS, FAAP**, from the Division of Pediatric Hospital Medicine. Co-investigators include **Janelle Fox, MD, MS, FACS**, from the Division of Pediatric Urology, and **Dana Y. Fuhrman, DO, MS**, from the Division of Pediatric Nephrology.

## Study Aims

Historically, chronic kidney disease and renal failure have been a leading cause of mortality in patients with spina bifida, though since the 1970s, significant progress has been made to improve patients’ renal health and long-term outcomes. However, renal injury and progression to chronic kidney disease and end-stage renal failure are still a cause of great concern for individuals with spina bifida.

One of the main goals for the new urinary biorepository is to search for potential biomarkers that can be studied and ultimately used as longitudinal predictors of renal function in the spina bifida patient population. The ability to predict which spina bifida patients may be most at risk for developing chronic kidney disease and its downstream effects would allow clinicians to better manage and treat patients in an ongoing manner through surveillance tactics and recognition of when clearly defined markers of health have changed. While not currently feasible with existing diagnostic tools, this approach is ultimately what the research team hopes to develop with their data.



“There has never been a prospective, longitudinal study of this kind conducted before, so we have the potential to make important findings that could reshape what we know about neurogenic bladder and its complications in individuals with spina bifida,” says Dr. Fox.

One aspect the study team has a particular interest in is the urinary microbiome. At baseline, individuals with spina bifida and neurogenic bladder have a perturbed bladder urothelium and a urinary microbiome that can vary widely across individuals. Urine samples collected throughout the study will be analyzed in an attempt to better characterize the general nature of the urinary microbiome and also how the microbiome varies across etiologies of neurogenic bladder, whether or not the microbiome changes significantly over time, and whether acute changes in individuals can potentially be used as biomarkers or predictors of renal fitness and for more accurately diagnosing urinary tract infections.

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# DIVISION NEWS

## UPMC Children's Division of Pediatric Urology Welcomes Alyssa Messina, CRNP



**Alyssa C. Messina, CRNP**, joined the Division of Pediatric Urology at UPMC Children's Hospital of Pittsburgh in October 2020. Prior to joining the Division, she practiced in the pediatric urology division at the Children's Hospital of Philadelphia after completing her nurse practitioner training at the University of Pennsylvania.

Ms. Messina specializes in dysfunctional voiding in the Division, treating patients for a wide range of dysfunctional voiding issues and conditions in children and adolescents. Her research interests and past work have involved studies in disorders of sexual development, genitoplasty, and the use of elastography in pediatric urology studies of varicocele. Since arriving at UPMC Children's, Ms. Messina has begun working with Rajeev Chaudhry, MD, on an ongoing study investigating aspects of enhanced recovery after surgery (ERAS) in pediatric urology patients. She also has an interest in conducting quality improvement and patient satisfaction research related to point-of-care ultrasound (POCUS). UPMC Children's has one of the largest POCUS programs in the United States, with the Division of Pediatric Urology being one of 13 specialties currently part of the program.

"My interest in pediatric urology was really driven by the ability to provide definitive corrections for some of the conditions we see in clinic, but I also have a great interest in the surgical aspects of the discipline and look forward to collaborating with our outstanding surgical team on many of their cases and research projects," says Ms. Messina.

Ms. Messina's other responsibilities in the Division of Pediatric Urology include being the Advanced Practice Provider (APP) supervisor for the Division, overseeing the clinical work of three mid-level providers, three nurses, and the scheduling team.

Another longer-term goal of Ms. Messina and the Division is to create a curriculum for pediatric urology in the Advanced Practice Provider (APP) Fellowship Program at UPMC Children's. The APP Fellowship Program provides rigorous training for interested candidates to specialize in a particular subspecialty and ultimately become autonomous providers within their discipline at UPMC Children's. There are currently 18 subspecialty programs available, with more planned for the future.

## Pediatric Urology Division Welcomes Victoria Morando, DNP, FNP-BC



The Division of Pediatric Urology at UPMC Children's Hospital of Pittsburgh welcomes advanced practice provider **Victoria N. Morando, DNP, FNP-BC**, to the Division.

Ms. Morando is a certified registered nurse practitioner. She is board certified by the American Nurses Credentialing Center. She earned her Bachelor of Science in Nursing and Doctorate of Nursing Practice from Robert Morris University. She began her career as a registered nurse at UPMC Children's Hospital of Pittsburgh in 2015, in the Pediatric Intensive Care Unit where she developed strong critical thinking and assessment skills. She transitioned to acute care nursing and was a nurse on the Pediatric and General Thoracic Surgery Unit, where she worked for close to five years. She provided care to medical, trauma, and surgical patients including ENT, Plastics, Urology, Colorectal, and Pediatric Surgery.

She has traveled to Nicaragua and Ecuador for medical mission trips to provide nursing care. Her DNP research project, entitled "Perianal Maceration in Pediatric Ostomy Closure Patients," was a registered clinical trial. She was awarded the OASIS Award for excellence in demonstrating principles of evidence based practice at UPMC Children's. She is a member of the National Association of Pediatric Nurse Practitioners (NAPNAP) and the Pennsylvania Coalition of Nurse Practitioners (PCNP). She is a Pittsburgh native and loves to spend time with her friends and family.

## New Biorepository *Continued from Page 5*

Because children with spina bifida typically all have some form or degree of neurogenic or neuropathic bladders, this patient population exhibits the highest risk for repetitive urinary tract infections and infections of increased severity. Distinguishing between urinary tract infection and asymptomatic bacteriuria in this patient population has always been difficult as current testing methods lack the sensitivity and specificity needed to deal with a patient population who have a baseline disturbed bladder environment. This no doubt has and continues to lead to many instances of inappropriate antibiotic use and its concomitant effects, such as multi-drug resistant infections.

Establishing a definitive approach to distinguishing actual urinary tract infections (UTI) from asymptomatic bacteriuria (ABU) that results from commensal colonization is a high priority for this and other vulnerable patient populations.

“A main aim of our study is to see if we can devise a better strategy for accurately and promptly diagnosing UTI in these patients by using individualized or etiology-specific microbiome marker panels that can show changes over time in comparison to baseline metrics,” says Dr. Fox.

Learnings from this research may also potentially help other patient populations for whom neurogenic bladder is of significant concern and can lead to some of the same downstream morbidities, for example, in individuals with spinal cord injuries.

“The data we collect may indicate useful biomarker profiles that we can use to predict the likelihood of renal injury and progression to chronic kidney disease, and how we treat urinary tract infections in these patients, how the microbiome influences or signifies the presence of UTI in individuals, and a step forward in the more judicious use of antibiotic therapies,” says Dr. Fox.

### Study Team Members

**Catherine Forster, MD, MS, FAAP** – Lead Investigator

**Janelle Fox, MD, MS, FACS** – Co-Investigator

**Dana Y. Fuhrman, DO, MS** – Co-Investigator

**Megan Cuda**

**Santhosh Donepudi**

**Jennifer Fantuzzo**

**Elizabeth Hartigan**

**Nina Kowalewski**

**Alyssa Messina, CRNP**

**Rachel Sada**

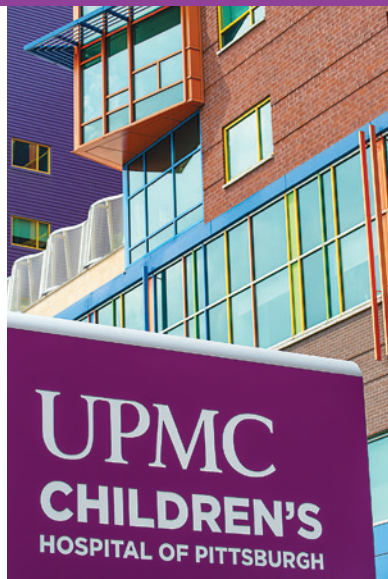
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## About UPMC Children's Hospital of Pittsburgh

Regionally, nationally, and globally, UPMC Children's Hospital of Pittsburgh is a leader in the treatment of childhood conditions and diseases, a pioneer in the development of new and improved therapies, and a top educator of the next generation of pediatricians and pediatric subspecialists. With generous community support, UPMC Children's Hospital has fulfilled this mission since its founding in 1890. UPMC Children's is recognized consistently for its clinical, research, educational, and advocacy-related accomplishments, including ranking 15th among children's hospitals and schools of medicine in funding for pediatric research provided by the National Institutes of Health (FY2019) and ranking on *U.S. News & World Report's* Honor Roll of Best Children's Hospitals (2021-22).