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AVOIDING COMPUTED TOMOGRAPHY SCANS BY USING POINT-OF-CARE ULTRASOUND WHEN EVALUATING SUSPECTED PEDIATRIC RENAL COLIC

Carrie Ng, MD* and James W. Tsung, MD, MPH†

*Department of Pediatrics, NewYork-Presbyterian Morgan Stanley Children's Hospital, Columbia University Medical Center, New York, New York and †Departments of Emergency Medicine and Pediatrics, Icahn School of Medicine at Mount Sinai, New York, New York
Reprint Address: Carrie Ng, MD, Department of Pediatrics, Columbia University Medical Center, 3959 Broadway, CHN-1-116, New York, NY 10032

☐ **Abstract—Background: Although renal colic in children in the United States remains relatively uncommon compared to in adults, its incidence has nearly doubled from 1999 to 2008. Noncontrast computed tomography (CT) is the current standard for the evaluation of suspected renal colic, given its high sensitivity and specificity. However, the greater lifetime risk of radiation-induced cancer from CT in pediatric patients has led to efforts to minimize radiation exposure. Additionally, pediatric renal colic is often recurrent, which might require multiple imaging studies during their lifetime. Point-of-care ultrasound (POCUS) by emergency physicians avoids radiation, has a low marginal cost, can be performed concurrently with other management, and allows for earlier diagnosis and more rapid treatment of renal colic. Adult randomized controlled trial evidence supports using POCUS as the initial approach to imaging and management of suspected renal colic. However, there remain limited data on POCUS in children for renal colic. Case Report: This is a case series where the sonographic findings of hydronephrosis, ureteral jets, "twinkling artifact," and the identification of urinary tract stones were used to evaluate adolescent and pediatric patients with renal colic. We report five cases of renal colic in adolescent and pediatric patients where urolithiasis was confirmed by using POCUS and irradiation by CT was avoided in all 5 patients. Why Should an Emergency Physician Be Aware of This?: POCUS can provide information about the presence or absence of urinary tract stones as well as obstruction of the collecting system without the cost and radiation exposure of CT.** © 2015 Elsevier Inc.

☐ **Keywords—pediatrics; point-of-care; ultrasonography; emergency medicine; renal colic; urolithiasis**

Streaming video: Five brief real-time video clips that accompanies this article are available in streaming video at www.journals.elsevierhealth.com/periodicals/jem. Click on Video Clips 1, 2, 3, 4, and 5.

INTRODUCTION

Although renal colic among children in the United States remains relatively uncommon compared to adults, its incidence has risen in the past decade and a half (1–3). Emergency department (ED) visits for pediatric renal colic have nearly doubled from 1999 to 2008, from 0.05% to 0.09% (1).

Noncontrast computed tomography (CT) is the current standard for evaluation of suspected renal colic, given its high sensitivity of 97% to 98% and high specificity of 96% to100% (4,5). However, the greater lifetime risk of radiation-induced cancer from CT in pediatric patients should prompt pediatric health-care providers to avoid harmful radiation-exposure from CT, when possible (6,7). Additionally, renal colic is often recurrent, with one studying showing 67% of pediatric patients with nephrolithiasis having two or more renal colic episodes

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in a 5-year span (8). Given the frequent need for diagnostic imaging in such patients, a valuable alternative to CT that avoids radiation is ultrasound (US).

Point-of-care ultrasound (POCUS) by emergency physicians has a low marginal cost, can be performed concurrently with other management, and allows for earlier diagnosis and more rapid treatment of renal colic (9). Adult randomized controlled trial evidence supports using POCUS as the initial approach to the imaging and management of suspected renal colic (10). However, there remain limited data on POCUS in children for renal colic. We report five cases of renal colic in adolescent and pediatric patients who were evaluated using POCUS to identify the presence or absence of hydronephrosis, ureteral jets and "twinkling artifact."

CASE REPORT

Case 1

An 18-year-old male patient with a history of renal colic diagnosed by a previous POCUS presented to the pediatric ED with acute right flank pain and dysuria. He reported that the pain was sharp and stabbing and was worse with activity, which was similar to his past renal colic. The patient had taken oral analgesics with no relief. He denied any fever, nausea, or vomiting and the remainder of his review of systems was also negative. In the ED, his vital signs were temperature, 36.8°C; blood pressure, 131/80 mm Hg; pulse rate, 82 beats/min; respiratory rate, 20 breaths/min; and O_2 saturation, 99% on room air. His examination was unremarkable except for right costovertebral angle tenderness.

POCUS showed right hydronephrosis with a 6.6-mm stone identified in the right ureterovesical junction with "twinkling artifact" described in the US technique section (Figure 1 and Video 1 http://youtu.be/vTyiofq-UsI). The patient was given analgesics and intravenous fluids. His pain resolved with passing of the stone and the patient was discharged home.

Case 2

A 19-year-old female patient with a medical history of pyelonephritis and nephrolithiasis diagnosed by a CT 5 months earlier presented to the pediatric ED with a 1-day history of right flank pain. She endorsed chills, nausea, and increased urinary frequency but, otherwise, the remainder of her review of systems was negative. She reported that her pain was similar to her previous episode of renal colic. In the ED, her vital signs were temperature, 37.2°C; blood pressure, 156/82 mm Hg; heart rate, 62 beats/min; respiratory rate, 20 breaths/min; and O_2 saturation, 96% on room air. Her examination was notable for right costovertebral angle tenderness and right lower quadrant tenderness to deep palpation with no rebound or guarding.

POCUS showed moderate right hydroureteronephrosis, which persisted post void. There was no sonographically identified calculus or perinephric fluid collection. The left kidney was within normal limits. Bilateral ureteral jets were visualized, with the right jet less than the left jet, consistent with a partially obstructing ureteral stone (Figure 2 and Video 2: http://youtu.be/YqYPEv8Jigo). Her urine pregnancy test was negative and her urinalysis showed moderate blood with small leukocyte esterase. She received analgesics and was discharged home with antibiotics because there was concern for pyelonephritis. Her urine culture was positive so she completed a course of antibiotics. She passed the stone without complication and has not had recurrence of renal colic as of the writing of this report.

Case 3

A 19-year-old girl with a history of recurrent renal colic diagnosed by two previous CTs and left ureteral stent placement 2 months prior presented to the pediatric ED with fever and left flank pain for 3 days. Of note, her ureteral stents were planned for removal 1 month earlier, but this was postponed for nonmedical reasons. Her pain was not relieved by analgesics and had been gradually worsening. She also noted hematuria with malodorous urine. The remainder of her review of systems was negative.

In the ED, her vital signs were temperature, 37.7°C; blood pressure, 110/57 mm Hg; pulse rate, 111 beats/min; respiratory rate, 20 breaths/min; and O_2 saturation, 99% on room air. On examination, she had significant left flank and costovertebral angle tenderness. She was treated for her pain and nausea. Her complete blood count was normal. Her urinalysis was notable for large blood and large leukocyte esterase and a urine culture was sent. POCUS showed migration of her left ureteral stent into her bladder with hydronephrosis of the left kidney and intrarenal stones (Figure 3 and Video 3: http://youtu.be/Yt8OLMOOaWk). An abdominal x-ray confirmed the displacement of her ureteral stent. She was started on antibiotics due to concern for pyelonephritis and she was admitted to the urology service for removal of her displaced ureteral stent. Lithotripsy was also performed. She completed a course of antibiotic therapy for a positive urine culture.

Case 4

A 3-year-old Hispanic boy with a recent history of urinary tract infection treated with oral antibiotics presented to the ED with persistent fever and dysuria. The patient's