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An Unusual Source of Sepsis in Two Previously Healthy Children

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Case Report 1

A 9-year-old previously healthy boy was transferred to our emergency room at a tertiary care medical center due to concern for sepsis. Two days prior to presentation, the patient complained of dysuria and later developed left flank pain and fever to 38.4°C the morning prior to presentation.

On initial evaluation at a regional hospital, urinalysis was notable for moderate bacteria, 10 to 25 red blood cells, and 5 to 10 white blood cells. Complete blood count demonstrated leukocytosis with neutrophilia. Computed tomography of the abdomen and pelvis was concerning for left-sided renal hypoattenuation, consistent with necrosis or developing intrarenal abscesses and pyelonephritis, as well as moderate ascites. There was initial concern for appendicitis based on imaging and clinical findings of severe abdominal and flank pain. The patient was subsequently started on intravenous clindamycin with an appendectomy later performed on the day of presentation. However, intraoperative findings were not consistent with appendicitis and demonstrated only mild injection of the appendix. His fevers persisted to 39.4°C postoperatively, and his abdominal and left flank pain worsened. The patient developed tachycardia and hypoxemia, with development of bilateral opacities on chest radiograph.

After initial fluid resuscitation, he was transferred to our facility for a higher level of care. Soon after arrival, urine and blood cultures from the outside facility resulted as positive, and ultimately grew methicillin-susceptible *Staphylococcus aureus*.

The patient had no personal or family history of urinary tract infections (UTIs) and underwent circumcision in the postnatal period. He had no history of enuresis or constipation, although he would often retain urine for up to 8 hours while playing video games, with subsequent extreme urgency. He had no previous hospitalizations, surgeries, or serious illnesses. He did have a history of mild eczema, which was well controlled at

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Author Contributions

SBF drafted the initial manuscript, and approved final manuscript. SK and JBW provided revisions and aided in the literature review. JEC reviewed the manuscript, aided in literature review, and revised content of drafts. All authors approved final manuscript.

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presentation, and he had one remote episode of impetigo. Prior to this hospitalization, he did not routinely take any medications.

Case 1 Hospital Course

On arrival to our facility, repeat blood and urine cultures were obtained. The patient was treated empirically with vancomycin while awaiting final culture results. Apart from continued left flank tenderness, abdominal tenderness, and diffuse crackles in bilateral lung fields, physical examination was nonfocal and he had no evidence of skin breakdown. An echocardiogram was performed, which showed normal anatomy without valvular vegetations.

A follow-up computed tomography (CT) of his chest, abdomen, and pelvis showed no visceral abscesses or occult foci of infection. He was transitioned to cefazolin once susceptibility results returned, and he clinically improved significantly prior to discharge.

The patient was evaluated by urology after hospital discharge, given concern for anatomic abnormality in an older patient with a primary UTI caused by an uncommon pathogen. Renal ultrasound performed after resolution of acute infection was notable for left renal scarring. Subsequent cystoscopy revealed additional tissue distal to the verumontanum.

Case Report 2

An 8-month-old boy with history of reactive airway disease presented to our facility as a transfer from a regional hospital for fever and concern for pneumonia. Two days before presentation, the patient developed fever, dyspnea, vomiting, and diarrhea. He was taken to a regional hospital and discharged home from the emergency room after receiving racemic epinephrine and albuterol treatments. The following day, he returned to the regional hospital with decreased responsiveness, persistence of fever, and dyspnea. On presentation to the emergency room, he was found to have increased work of breathing and hypoxia. A chest radiograph was concerning for right-sided pneumonia. He was given a dose of intravenous ceftriaxone, steroids, and a fluid bolus prior to transfer to our facility.

On arrival to our emergency department, the patient became lethargic and was intubated. Repeat chest radiograph demonstrated a right-sided pleural effusion. Laboratory evaluation was significant for mild elevation of hepatic enzymes, elevated creatinine, and trace bacteria, 24 red blood cells, and 124 white blood cells on urinalysis with microscopy. The patient was started on vancomycin and admitted to the pediatric intensive care unit. A renal ultrasound was performed and revealed grade 3 to 4 bilateral hydronephrosis and hydroureter with associated increased cortical echogenicity, poor cortical medullary differentiation, and cortical thickening. Urology and nephrology were consulted to assist in the management of his acute kidney injury. The patient's urine, blood, and tracheal cultures subsequently grew methicillin-susceptible *Staphylococcus aureus*.

Case 2 Hospital Course

The patient was transitioned to nafcillin monotherapy after the organism susceptibilities were available. He improved clinically with negative growth of his blood and urine cultures after 3 days. He was extubated on hospital day 4. Because of persistent fevers, an abdomen and pelvis CT was performed to evaluate for an occult focus of infection. This study revealed a right-sided perinephric fluid collection. Repeat renal ultrasounds showed persistence of hydronephrosis. Urology performed a cystoscopy to place a nephrostomy tube at which time large membranes near the prostatic portion of the urethra.

Final Diagnosis

Posterior urethral valves.

Discussion

Pyelonephritis is the most common serious bacterial infection in childhood and can lead to acute sequelae such as urosepsis, as well as long-term sequelae such as hypertension and renal failure.¹ The prevalence of UTIs varies by age and is much more frequent in females than males due to anatomic differences in urethral length. UTIs in males are typically more complicated, as they are most frequently associated with urologic or renal anatomic or functional abnormalities, instrumentation, or obstructive pathology.²

Staph aureus is the most common invasive pathogen in the United States, and is a major cause of morbidity and mortality. However, it remains an uncommon cause of UTI in children without an indwelling urinary catheter.³

The unique features of these cases are the late presentation of posterior urethral valves (PUV), as well as the relatively older age of onset, male sex, and uncommon pathogen associated with a first UTI. Given both patients' presenting symptoms, it is likely that the primary focus of infection was the urinary tract with subsequent progression to a disseminated infection, rather than a primary hematogenous infection with secondary renal involvement.

The patients' older age and male sex are uncommon for a first-episode UTI; therefore, suspicion for possible anatomic abnormality was warranted. PUVs are the most common cause of lower urinary tract obstruction in male neonates, with an incidence of 1 case per 8000 to 25 000 live births; late presentation of PUV accounts for about 10% of PUV cases.⁴ Patients presenting late with PUV may display recurrent UTIs, bladder storage and emptying symptoms, incontinence, and sexual dysfunction.⁵

The patients' demographic and clinical features are consistent with findings previously published by Megged,⁶ in which retrospective chart review identified 26 children with *Staph aureus* UTI, and compared demographic, clinical, and laboratory data with 52 cases of *Escherichia coli* UTI. Children with *Staph aureus* UTI were more likely to have abnormal radiologic findings on ultrasound (77% vs 22%; $P < .001$) or voiding cystourethrogram (53% vs 23%; $P < .001$), and more likely to have vesicoureteral reflux (50% vs 23%; $P < .$

001). The study also identified 4 children with *Staph* UTI and vesicoureteral reflux in whom there was no prior history of UTI, although did not comment on whether any patients in the study had PUV.

There is debate regarding the clinical significance of *Staph aureus* found in urine cultures, especially in adults with indwelling urinary catheters. In otherwise healthy children, *Staph aureus* bacteriuria should be considered a pathogen and warrants investigation for a urinary tract abnormality. In our case series, the patients required significant fluid resuscitation and supplemental oxygen likely due to septic shock.

Conclusion

We present 2 cases of methicillin-susceptible *Staphylococcus aureus* pyelonephritis as the primary source of *Staph aureus* sepsis, in 2 immunocompetent children without history of UTIs. Both were ultimately found to have posterior urethral valves, which highlights the importance of investigating for a urinary tract abnormality in patients that share a similar presentation.

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