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PYELONEPHRITIS IN CHILDREN: DIAGNOSIS AND TREATMENT

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Abstract: *Urinary tract infections (UTIs) often occur in children. It is estimated that 8% of girls and 2% of boys will have at least one episode by age seven. Of these children, 12–30% will relapse within one year. Australian hospitalization records show that pediatric UTIs account for 12% of all UTI hospitalizations. The purpose of this article is to review the pathogenesis, clinical assessment, and treatment of UTIs, as well as prevention strategies in children. Clinically, pediatric manifestations of UTIs are complex as symptoms are vague and variable. Young children may present with sepsis or fever and no specific symptoms, while older children may present with classic signs such as dysuria, frequent urination, and low back pain. Early diagnosis, using appropriate methods of urine collection, testing, and treatment, is essential to prevent kidney damage and recurrence. Effective, evidence-based studies and treatment options are available, and clinicians should feel confident in identifying and treating UTIs in children.*

Key words: *Pediatric, young children, non-specific manifestations.*

Introduction

Relevance. Urinary tract infections (UTIs) are common in childhood. It is estimated that 2% of boys and 8% of girls will have a UTI by age seven, and 7% of infants with fever will have a UTI [4, 7] . Pediatric UTIs, especially in young children, have varied and non-specific manifestations. which may go unnoticed or misdiagnosed [3, 5] . Delay in diagnosis and treatment of UTIs can potentially lead to kidney damage and loss of renal function [4, 10] .

The purpose of this article is to provide clinicians with an overview of the evaluation and management of children with UTIs.

Pyelonephritis is an ongoing purulent infection of the kidneys that occurs almost exclusively in patients with severe anatomical abnormalities. Symptoms may be absent or may include fever, malaise, and side pain. Diagnosis is based on urinalysis, culture, and imaging tests. Treatment consists of antibiotics and correction of any structural abnormalities. The usual mechanism is reflux of infected urine into the renal pelvis. Causes include obstructive uropathy, struvite stones, and, most commonly, vesicoureteral reflux (VUR). Pathologically, there is atrophy and deformation of the calyces with scarring of the parenchyma. Chronic pyelonephritis can progress to chronic kidney disease. Patients with chronic pyelonephritis may have residual foci of infection that may predispose to bacteremia or, among kidney transplant patients, contamination of the urinary tract and transplanted kidney.

The pathogenesis of UTIs. UTIs often develop when uropathogens ascend from periurethral colonization into the bladder (cystitis). From the bladder, uropathogens can enter up the urinary tract (pyelonephritis) or enter the bloodstream (urosepsis). UTIs resulting from hematogenous and direct invasion are rare. Urine is sterile, but uropathogens can enter during catheterization, turbulent urination, sexual intercourse, or manipulation of the genitals. Susceptibility to UTIs is determined by bacterial virulence, anatomical features (gender, vesicoureteral reflux [VUR], circumcision), bowel or bladder dysfunction leading to urinary stasis (constipation and neurogenic bladder), and host defense mechanisms (genetics and periurethral flora). and gastrointestinal tracts) . In the first year of life, UTIs are more common in boys than girls and are 10 times more common in uncircumcised boys compared to circumcised boys. The incidence of UTI falls below 1% in school-age boys and increases to 1-3% in school-age girls.

Etiology. Most UTIs are caused by Gram-negative bacteria, of which Escherichia coli is the most common (>75% of UTIs). 8 , 9 Other bacteria that cause UTIs include Proteus, Klebsiella, Enterobacter, Citrobacter, Enterococcus, and Staphylococcus saprophyticus. Fungal UTIs, such as Candida albicans infections, often coincide with recent antibiotic treatment, bladder catheterization, or immunosuppression. 10 Symptomatic viral UTIs are rare; however, adenoviruses are known to cause hemorrhagic cystitis, and the VC virus (polyoma virus) is the causative agent associated with immunosuppression.

Classification of UTIs. UTIs are classified according to clinical signs (asymptomatic and symptomatic), anatomical signs (cystitis and pyelonephritis), and frequency of occurrence (single and recurrent). Recurrent UTIs are often the result of: inadequate antimicrobial therapy, noncompliance, bacterial resistance, host susceptibility, factors contributing to urinary stasis.

Clinical signs and symptoms. The clinical picture is variable and often non-specific, especially in young children. This complicates the early diagnosis and treatment of UTIs in children. Thus, UTI should be suspected in every febrile infant until proven otherwise. History taking includes antenatal history as well as family history of urological abnormalities, especially VUR. A complete urinary history should include frequency, urgency, flow, volume, suprapubic pain, dysuria, secondary enuresis, and toileting practices. Another important history includes fluid intake and bowel habits. In young children, caregivers may report non-specific symptoms such as lethargy, fever, vomiting, malaise, developmental delay, irritability, and foul-smelling urine.

None of the physical signs are pathognomonic for UTI. On examination, physicians should quickly assess whether the patient appears "ill" or "well" and suspect fever, hypertension, a palpable bladder, leakage or tension, and lumbar or suprapubic tenderness. Although the physical examination is often unremarkable, it should include assessment of the abdomen, vulva, lower extremities, and hydration status. In rare cases, underlying conditions that contribute to UTIs may be present, such as spina bifida, phimosis.

Diagnostics. Urinalysis is a fast, non-invasive method for detecting UTIs. However, urinalysis alone is not enough to diagnose a UTI. Positive nitrite (75% chance of UTI) and positive leukocyte esterase (30% chance of UTI) may indicate UTI. Urinalysis has a sensitivity of 82.5%, a specificity of 81.3%, a positive predictive value of 33.9%, and a negative predictive value of 97.6%.

17 In children with fever, urinalysis can help determine who should receive antibiotic treatment while cultures are pending.

The diagnosis of UTI is based on clinical symptoms combined with a positive urine culture. The amount of bacterial growth required to obtain a positive culture depends on the age and method of urine collection. Although treatment may be started before culture results are available, the pathogen and antibiotic susceptibility should be assessed in order to formulate a targeted therapeutic regimen.

Visualization of the urinary tract . In most cases, imaging of the urinary tract is not recommended after the first UTI. Renal ultrasonography rarely provides information that changes treatment tactics. Clinicians should be aware of the indications and limitations of urinary tract imaging and should be guided by clinical judgment when seeking additional imaging. Table 2 summarizes the indications, uses, and limitations of common urinary tract imaging modalities.

Treatment for UTIs . Treatment and care includes good communication between health professionals, children and caregivers. Gillick competent children should be involved in managing their own health. Treatment should be adapted to the clinical severity and depends on the age of the child. Broad-spectrum oral antibiotics treat most uncomplicated UTIs. By comparison, children with overt sepsis who are in shock and/or under 3 months of age should be actively treated with parenteral antibiotics and intravenous fluids. These patients should be referred to the hospital for a complete septic screening, including lumbar puncture and pediatric examination. The choice of antibiotic is determined by microbial susceptibility and local regulations. Each patient should be re-evaluated 48 hours after starting antibiotic therapy, and treatment should be modified according to culture and sensitivity. Empiric therapy with gentamicin should not be used for more than three days. If empiric therapy is still required, consideration should be given to switching to ceftriaxone to reduce the risk of nephrotoxic and ototoxic side effects.

Surgical treatment . Available data suggest that boys have a 1% risk of UTI in the first year of life, but this risk drops to 0.1% if they are circumcised. 2 Routine circumcision is not recommended given that approximately 111 boys would need to be circumcised to prevent one UTI. However, having a first UTI in the first year of life poses an additional risk, and circumcision may provide additional benefits, especially for patients with recurrent UTIs or grade III–V VUR. Before circumcision, hypospadias should be assessed. In addition, surgical correction of VUR should only be considered in cases of persistent grade III-V VUR and/or ineffective continuous antibiotic treatment.

Prevention and follow-up. According to Australian guidelines, antibiotic prophylaxis is not recommended for children after a first UTI. 15 Antibiotic prophylaxis should be considered instead for grade III–V VUR and/or complicated recurrent UTIs. This decision should be made by a specialist doctor or general practitioner specializing in paediatrics. Trial antibiotic prophylaxis should be reviewed every six months. In addition, conservative measures should be taken to limit recurrence, such as increasing fluid intake, avoiding bubble baths, improving hygiene, and eliminating constipation and problems with urinary dysfunction.

Infants usually do not require follow-up if they had asymptomatic bacteriuria or normal imaging. Children with recurrent UTIs should be seen by a pediatrician, and additional imaging, blood pressure monitoring, and evaluation for proteinuria may be required. Infants with impaired renal function or bilateral renal abnormalities require close pediatric attention, annual blood pressure monitoring, renal imaging, and renal function tests. It is important to note that any febrile event in these children should be investigated by urine culture.

Conclusion. UTIs are a common cause of childhood illness. They pose a risk of kidney scarring and could potentially contribute to the lifelong incidence of hypertension and chronic kidney disease. Proper diagnosis and treatment of UTIs are important. Treatment is aimed at treating the acute episode, identifying the etiology, and preventing relapse. The collection of sterile urine specimens is fundamental to making a diagnosis. When indicated, renal ultrasonography can prevent recurrent UTIs by detecting structural abnormalities that require subsequent renal imaging and further intervention. In most cases, antibiotic prophylaxis and surgery are not required to prevent UTIs. Rather, good hygiene, prevention of constipation, adequate fluid intake, and full bladder emptying can help prevent most relapses.

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