PERSPECTIVE

Paediatric febrile urinary tract infections and antibiotic resistance

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ABSTRACT

The most common cause of serious bacterial disease in infants under the age of two is now thought to be a febrile UTI. In children, UTI can permanently harm the renal parenchyma, causing chronic renal insufficiency and other issues. Early and efficient antibiotic treatment is crucial to avoiding this danger. Additionally, quick treatment is essential to enhance the patient's clinical state, avoid bacteraemia, and reduce the chance of bacterial localisation in other body sites. However, as bacterial infections linked to UTIs become more resistant to antibiotics, recommendations quickly become outdated and determining the optimal empiric antibiotic therapy becomes more challenging. Antibiotic susceptibility of pathogens varies, and this variation is crucial for selecting a treatment that works. Furthermore, the risk of ineffective treatment can be decreased by correctly identifying patients who are more likely to develop difficult-to-treat UTIs

INTRODUCTION

The prevalence of serious bacterial illnesses in infants and young children, such as bacteremia and meningitis, has significantly decreased during the past 20 years as a result of the widespread use of conjugate vaccinations against *Streptococcus pneumoniae* and *Haemophilus influenzae*. As the most common cause of serious bacterial disease in infants under the age of two, febrile urinary tract infection (UTI) has gained increasing clinical relevance as a result of this. Febrile UTI, which is typically considered a sign of an upper UTI called pyelonephritis, can permanently harm the renal parenchyma and cause chronic renal insufficiency and other issues. It is crucial to offer antibiotic treatment that is effective against the bacterial pathogen causing the fever within 3–4 days of the onset of the illness in order to reduce this risk. However, quick therapy is necessary to enhance the patient's clinical state, avoid bacteraemia, and reduce the chance of bacterial localization in other body sites. Unfortunately, formal UTI diagnosis and pathogen detection are sometimes delayed, and the initial course of treatment is still empiric. The signs and symptoms of sickness are vague in newborns and young children. The only early sign of a kidney infection is frequently a fever without a known cause, which might delay diagnosis. A sterile bag attached to the perineum or a clean catch midstream void are typically used to collect urine for culture, the sole means to diagnose UTI, in order to avoid intrusive procedures. False positive results, which necessitate confirmation with a second invasive test and delay the selection of the most efficient antibiotic medication, are frequent with these procedures. The disadvantage explains why it is advised to start empiric antibiotic treatment as soon as a urine specimen has been obtained for culture when pyelonephritis is strongly suspected based on clinical manifestations and/or laboratory tests, even if the diagnosis is not final and the infecting pathogen and its sensitivity to antibiotics are not clearly defined. Official rules specify which antibiotics must be administered in order to ensure the greatest likelihood of bacterial eradication. The list is routinely updated taking into account changes in the uropathogens antibiotic sensitivity throughout time. However, antibiotic resistance for UTI-related bacterial infections continues to rise, making recommendations quickly out-of-date and the determination of the optimal empiric antibiotic therapy increasingly challenging. This is true even though there is a difference between inpatients and outpatients. This implies

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that the advised empiric treatment may not always be successful, with a possible increased risk of short-term or long-term problems. For the selection of a successful medication, knowledge of the causes of upper UTIs and variations in pathogen susceptibility to antibiotics is crucial. Furthermore, the risk of ineffective treatment can be decreased by correctly identifying patients who are more likely to develop difficult-to-treat UTIs. The issue of microorganisms linked to the development of paediatric febrile UTIs developing antibiotic resistance and the best possible ways to provide the most effective therapy will be covered in this study. Medline, Embase, and the Cochrane Library were used for the literature search. Urinary tract infections in children or its derivatives were mentioned. A total of 1,440 abstracts in the English language were checked for relevance, and 101 full texts were retrieved for evaluation. Publications were taken into consideration when the findings discussed the etiology, uropathogen resistance, antibiotic therapy for children with UTIs, or when the publication provided fresh information regarding antibiotic resistance in pediatric UTIs. Bacteria almost always cause a femoral UTI, and gender isn't a factor that really matters. Rarely, but generally only in the lower urinary tract, can viruses such adenoviruses, enteroviruses, echoviruses, and coxsackieviruses cause UTI. Pyelonephritis can be caused by fungi, primarily *Candida spp., Aspergillus spp., and Cryptococcus neoformans*, but this type of infection is extremely uncommon and typically affects kids with certain clinical conditions, such as long-term antibiotic therapy, a history of urinary tract medical implants, or severe immune deficiency. The primary pathogens of UTI are gram-negative rods originating from the gut microbiota. Across hospital and community settings, Escherichia coli is the most prevalent in all age groups and makes up up to 90% of all the causal agents. This is due to the fact that *E. coli* has a variety of adhesins that enable the pathogen to attach to the uroepithelium despite the flushing impact of urine flow. Additionally, following invasion of the urinary tract, the pathogen is shielded from the human immune system by an intracellular biofilm. Other typical gram-negative uropathogens include Proteus mirabilis, Klebsiella pneumoniae, and Pseudomonas aeruginosa. Their importance, which is often low in children with first upper UTIs who are otherwise healthy, greatly increases in instances that have already received multiple rounds of antibiotic treatment and in cases that are related to invasive operations or indwelling catheters. Curiously, multiple studies have shown that while K. pneumoniae and P. mirabilis are more frequently identified in males and E. coli is the most frequent causal organism at all ages regardless of patient demographic features, it is more frequently discovered in females. Gram-positive bacteria, such as Staphylococcus aureus, streptococci of the viridans group, and Streptococcus pneumoniae, seldom cause upper UTIs; only 5% of cases result in their culture. The majority of cases of upper urinary tract involvement are limited to individuals with weakened immune systems and a small number of children with abnormal urine flow brought on by anatomical, functional, or neurological factors. They typically produce lower UTIs. Pyelonephritis infrequently contains Staphylococcus saprophyticus, the causative agent of up to 15% of lower UTIs in teenagers and sexually active girls. Finally, group B Streptococcus infections can arise in neonates where Gram-negative rods are still common.