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Infectious Diseases Concomitant with Urinary Tract Infections in Children

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Abstract: Urinary-tract infection (UTI) is one of the most common infectious diseases in children; however, the significance of combined infection in the pathogenesis of UTI remains uncertain. Of 48,382 patients discharged from Texas Children's Hospital from July 1, 1991, to June 30, 1994, 1,221 (2.5%) were discharged with a diagnosis of UTI. We retrospectively reviewed the files of these 1,221 patients to assess for concomitant infections and causative microorganisms in patients with first-time UTI, no urologic abnormalities, and no other major diagnoses. Of the 1,221 patients, 511 (42%) had first-time UTI with no urological abnormalities or other major diagnoses, of which 449 (87.8%) had UTI only, and 62 (12.1%) had concomitant infectious diseases. The 62 patients with concomitant infections comprised the study group for our series. There were 38 boys and 24 girls with a mean age of 2.9 years. Most of the patients (42/62) were younger than 1 year old.

Eighteen patients had otitis media, 16 had acute pneumonia, 14 had acute bronchiolitis, 5 had acute gastroenteritis, 4 had meningitis, 2 had upper respiratory tract infection, 1 had eye infection, 1 had vaginitis, and 1 had vulvovaginitis and salpingo-oophoritis. *E. coli* was the most common pathogen, accounting for 34 (51.5%) of the organisms isolated in these patients, followed by *Klebsiella*, which accounted for 10 (15.2%) of the isolated organisms.

We conclude that many patients diagnosed with UTI may have concomitant infectious diseases as well, particularly children younger than 1 year old who have nonspecific symptoms. Evaluation of UTI is particularly important in young children who experience frequent childhood infections.

Key Words: Urinary tract, infection, concomitant infectious disease.

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Introduction

Urinary-tract infection (UTI) is among the most serious infectious diseases in children. Respiratory-tract infections, otitis media, and gastrointestinal infections are the common infections diagnosed in pediatric emergency and outpatient settings, and occasionally occur in association with UTI; however, the significance of combined infections in the pathogenesis of UTI remains uncertain. Upper-respiratory tract infection occurs in 13 to 30% of patients with UTI (1, 2). Torrijos et al. (3) found that 17 (16%) of 106 infants presenting with a initial diagnosis of otitis media had documented UTI. The purpose of this study was to determine the types of infectious diseases that occur concomitantly with first-time UTIs in hospitalized children, and the microorganisms that cause these infections.

Patients and Methods

Patients discharged from Texas Children's Hospital, Houston, Texas, between July 1, 1991 and June 30, 1994, who had been diagnosed with UTI were included in this study. Patients in the following groups were excluded from the study: 1) those with one or more major diagnoses such as cardiologic, oncologic, or hematologic diseases; 2) those with known urologic abnormalities; 3) those with recurrent infections; 4) those with persistent bacteriuria; 5) and those with nosocomial UTI. Information about the patients' age, sex, race, routine urinalysis results, causative microorganisms, and other diagnoses was obtained from the charts. The diagnosis of UTI was based on the following 1) a colony count of at least 10^5 organisms/ml in a midstream, clean-voided specimen and 2) 10^4 or more colonies/ml in catheterized urine specimens, in symptomatic children.

Results

Patients

Of 48,382 patients discharged, 1,221 (2.5%) had a discharge diagnosis of UTI. Five hundred eleven (42%) children fulfilled our study criteria. Of these, 449 had UTI only, and 62 (12.1%) had concomitant infections. The latter group comprised the study group for this series.

Of the children with concomitant infections, 38 were boys and 24 were girls. The children ranged in age from 6 days to 18 years (mean age 2.9 years). Forty-two were younger than 1 year old. Twelve of the children were White, 24 were Black, 25 were Hispanic, and one was Asian.

Urinalysis

A urinalysis was performed on all patients in the study group the same day the infection was documented. In 24 (39%) urinalyses, more than five white blood cells were noted on each high-power field.

Concomitant Disease

Eighteen patients had otitis media. Sixteen patients had acute pneumonia; four cases were caused by respiratory syncytial virus (RSV) and one was caused by *aemophilus influenza*. Fourteen patients had acute bronchiolitis, eight cases of which were caused by RSV. Four patients had meningitis: one was suspected viral meningitis, one was *P. aeruginosa*, one was *H. influenza*, and one case was of unknown etiology. Five patients had acute gastroenteritis, three cases were caused by coronavirus, one was caused by rotavirus, and one was caused by *Shiegella flexneri*. Two patients had upper respiratory-tract infections caused by *Streptococcus*. One patient had eye infection caused by Herpes virus type 1. One had vaginitis caused by *Neisseria gonorrhoeae*. One patient had vulvovaginitis and salpingo-oophoritis caused by *Candida albicans*. Table 1 lists the concomitant infections in this group of patients.

Microorganisms

Fifty-one of the urine cultures were taken from catheter specimens, and 11 were taken from mid-stream, clean-voided specimens. Colony counts were greater than 10⁵ in 53 patients and 10⁴ in nine patients.

Sixty-six microorganisms were isolated in the 62 patients. *Escherichia coli* was the most common pathogen, accounting for 34 (51.5%) of the 66 microorganisms.

Table 1. Concomitant infectious diseases in children with urinary tract infections.

Diseases	No.of patients	%
Otitis Media	18	29
Acute pneumoniae	16	25.8
Acute bronchiolitis	14	22.6
Acute Gastroenteritis	5	8.1
Meningitis	4	6.5
Upper respiratory tract infection	2	3.2
Eye infection	1	1.6
Vaginitis	1	1.6
Vulvovaginitis + Salpingo-oophoritis	1	1.6
Total	62	100

Table 2. Causative microorganisms in children with UTI and concomitant infectious disease.

Microorganisms	No. of microorganisms	%
<i>E. coli</i>	34	51.5
<i>Klebsiella</i>	10	15.2
<i>Enterococcus</i>	5	7.6
<i>Proteus</i>	3	4.5
<i>Pseudomonas</i>	3	4.5
<i>Staphylococcus</i>	3	4.5
<i>Streptococcus</i>	3	4.5
<i>Enterobacter</i>	1	1.5
<i>Citrobacter Freundii</i>	1	1.5
<i>Shiegella Flexneri</i>	1	1.5
<i>Candida Albicans</i>	1	1.5
<i>H. Influenza</i>	1	1.5
Total	66	100

Klebsiella was the second most common pathogen, accounting for 10 (15.2%) of the 66 microorganisms. Other microorganisms isolated were *Enterococcus*, *Pseudomonas*, *Streptococcus*, *Staphylococcus*, *Enterobacter cloacae*, *Citrobacter freundii*, *S. flexneri*, *C. albicans*, and *H. influenzae*. One patient had positive urine and cerebrospinal fluid cultures for *P. aeruginosa*, one had positive urine and stool culture for *S. flexneri*, and one had positive urine culture and tracheal secretion for *H. influenza* without growth in blood culture.

Discussion

Our study shows that 12.1% of hospitalized patients with first-time UTI and without major diagnosis had

concomitant infectious diseases. The prevalence of upper respiratory tract infection in association with UTI ranges from 13 to 30% (1, 2). In Stanfield's study (1), acute respiratory-tract infection was noted within 1 week of the onset of UTI in 13% of cases. In Burke's series (2), 4 of 16 children who had one occurrence of pyelonephritis and 16 of 39 children with more than one occurrence also had upper or lower respiratory-tract infection. Acute otitis media is another common diagnosis in pediatric emergency and outpatient settings, and it is occasionally associated with UTI (3). In a study by Torrijos et al. (3), 17 (16%) of 106 infants diagnosed with otitis media also had documented UTI. In our series, 18 (29%) of 62 children with UTI were diagnosed with otitis media before or during admission.

Most of our patients with concomitant infectious diseases were younger than 1 year old. The immunologic status of these patients and their susceptibility to infection may explain the higher percentage of concomitant disease in this group.

The significance of combined infection in the pathogenesis of UTI is not well established. It is likely that one infection leads to another, but it is difficult to determine which infection occurs first. An initial viral or bacterial infection may temporarily compromise host defenses by reducing the effect of the cell-mediated immune defense system or of the mucous membranes. In such a situation, the ability of the uroepithelial cells to kill bacteria may be hindered (4). In the event of infections which precede UTI, the patient may have decreased intake of fluids or may vomit fluids, and with increased body temperature there will be increased insensible fluid loss and possibly increased sweat loss. This decreased intake and increased fluid loss will lead to reduced urine output and a longer time interval between voidings, allowing organisms in the urinary tract to multiply.

Changes in the immune system are also intimately related to the progression of various infectious diseases. For example, suppression of neutrophil function may occur as a stage in the pathogenesis of bacterial UTI (5). This suppression may play a role in other infections, including otitis media. Proteins such as streptolysin generated by gram-positive organisms (6) and *pha*-hemolysin generated by gram-negative organisms (7) may predispose the host to other infections by suppressing polymorphonuclear neutrophil function. Induction of similar adverse effects on

polymorphonucleocytes by viruses has been well documented (8, 9). Twelve of our patients had respiratory tract infection caused by RSV, four had gastroenteritis (three caused by picornavirus and one caused by rotavirus), and one had viral eye infection.

E. coli was the most common pathogen in these patients, followed by *Klebsiella*. Because the principal reservoir of infectious agents for the urinary tract is the flora of the external genital, perineal, and perianal regions, the organisms most frequently implicated in UTI include species of *Enterobacteriaceae*, especially *E. coli* and other gram-negative enteric organisms (10). Torrijos et al. found *E. coli* to be a common pathogen in patients with otitis media and UTI (3).

As previously reported (11), the absence of pyuria does not rule out UTI. Fewer than 5 white blood cells per high power field were found in 38 (61.3%) of our patients. Because fever is a common symptom in minor and major diseases, antibiotics are used widely. It has been established that a single dose of antibiotic, including ampicillin, which is commonly used for otitis media, can eradicate urinary-tract pathogens (12, 13). In our series, 11 patients had taken antibiotics for otitis media or upper respiratory-tract infection before admission. For this reason, urine cultures should be obtained before the first dose of antibiotic is administered. This point should be stressed with parents when urine cultures are to be collected at home.

Conclusion

We conclude that many patients diagnosed with UTI may have concomitant infectious diseases as well, particularly children younger than 1 year old who have nonspecific symptoms. Evaluation of UTI is particularly important in young children who experience frequent childhood infections.

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