

Significance of *Salmonella typhi* Bacteriuria

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Bacteriuria due to *Salmonella typhi* usually occurs following recent typhoid fever or in chronic carrier states. Data from 18 patients with *S. typhi* bacteriuria, seen during 5 years, were analyzed. Fourteen patients had localized urinary tract infection due to *S. typhi*. Four others had bacteriuria, probably associated with typhoid fever. Localized abnormalities of the urinary tract and kidneys and also systemic diseases were found to predispose patients to *S. typhi* bacteriuria. Local abnormalities encountered included urolithiasis ($n = 3$), prostatic hypertrophy ($n = 1$), and tuberculosis ($n = 1$). One renal transplant recipient and another with lupus nephritis had *S. typhi* bacteriuria. One had associated strongyloidosis, and another was pregnant.

Typhoid fever is the most common illness caused by *Salmonella typhi* (1, 5, 7). Other, less frequent manifestations of this infection include localized infections of soft tissue, bones, joints, and the genital tract (1, 2, 9).

Recovery of *S. typhi* from urine is a rare event, even in areas endemic for this infection (8–10). *S. typhi* can be isolated from urine following a recent episode of typhoid fever, in chronic carrier states involving the urinary system, and occasionally following localized urinary tract infection (UTI) due to *S. typhi* (1–4). The former two conditions are likely to be asymptomatic. The last situation is extremely rare, tends to be chronic, and occurs in individuals with structural or functional abnormalities of the urinary tract (2, 4, 7, 10, 11). Acute symptomatic UTI is not a recognized manifestation of *S. typhi* infection. The information available currently on bacteriuria due to *S. typhi* is based on a few reports, most of which were published two decades ago. In an attempt to define the significance of *S. typhi* bacteriuria in present-day clinical practice in an area where it's endemic, we have reviewed the cases of patients with *S. typhi* bacteriuria in our practice during the past 5 years.

MATERIALS AND METHODS

The records of adult patients maintained in the hospital from whom *S. typhi* was isolated from urine during the period January 1987 to December 1992 were reviewed.

For culture, midstream clean-catch samples of urine are routinely transported without delay to the laboratory and 0.01 ml is plated onto blood and MacConkey agars. After overnight incubation, the colonies are counted and identified on the basis of biochemical reactions and type of antigen (H or O) (5). The isolates obtained either in pure culture or in association with one other organism were included for the review. When *S. typhi* was isolated along with a mixture of other organisms, fecal contamination of improperly collected urine was assumed and the sample was excluded from analyses.

RESULTS

S. typhi was obtained in pure culture from 16 patients and along with one other organism from 2 patients. Clinical and laboratory data of these patients are listed in Table 1.

Fourteen patients (78.6%) had symptoms of UTI, like dysuria and frequent urination, with four patients complaining of recurrence of these problems. Fever ($>99^{\circ}\text{F}$ [ca. $>37^{\circ}\text{C}$]) was absent in five of these patients. Of the remaining nine, two

patients had fever of a <1 -week duration, four had fever for up to 2 weeks, and three had fever of a >1 month duration. A case of fever, probably typhoid, occurring 9 months earlier was documented for one patient. Blood cultures were done for six patients, five of whom were febrile, but only one culture yielded *S. typhi*. The latter patient, who was pregnant, had fever for 11 days and presented with loin pain. Thirteen of 14 patients (93%) had leukocyturia, and 8 of 9 patients tested (89%) had proteinuria. *S. typhi* was isolated from urine of all patients in counts of $>10^3$ CFU/ml. Eight patients had $>10^5$ CFU of *S. typhi* per ml.

Three of the four patients without symptoms of UTI presented with symptoms pertaining to the gastrointestinal tract, like vomiting, diarrhea, and abdominal pain. Two of these patients had intermittent fever of a 2-month duration, and the other patient had fever for 5 days. The fourth patient presented with an 18-day history of fever without localizing signs. Blood culture for one of these patients yielded no growth. All four patients had leukocyturia and *S. typhi* in urine in counts of $>10^5$ CFU/ml.

Conditions that could predispose one to UTI were noted for 13 patients (72%) (Table 1), three of whom had urolithiasis and one of whom was a renal transplant recipient. Five patients, three women and two men, did not have any detectable underlying factors predisposing to UTI.

The patients were treated with an appropriate antibiotic, namely, chloramphenicol, ciprofloxacin, ampicillin, or co-trimoxazole. The calculi were removed surgically. During the 1-year follow-up period, the patients remained symptom free. Repeat urine cultures were done for six patients; two of these cultures yielded *S. typhi*. These cultures became negative 4 and 7 weeks later.

DISCUSSION

S. typhi bacteriuria is rare even where it's endemic (8–10), and the clinical significance is not clear. Although a few reports are available on the role of *S. typhi* in causing UTI (8, 10, 11), the popular belief is that *S. typhi* is shed in urine following a recent typhoid fever as part of the natural history of this disease or in chronic carrier states. In this study, of 18 patients with *S. typhi* bacteriuria, 14 had symptoms of a UTI clinically indistinguishable from UTIs due to other etiological agents except for the long duration of fever in 3 patients. Proteinuria and leukocyturia in 89 and 93% of these patients, respectively,

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TABLE 1. Summary of findings for 18 patients with *S. typhi* bacteriuria

Characteristic	No. of patients (%)	Relevant features ^a (n)
Symptoms		
Dysuria	12 (67)	Abdominal pain (1)
Abdominal pain	3 (17)	
Fever	13 (72)	>1 mo (5), 1 wk–1 mo (5), <1 wk (3)
Laboratory findings		
Pyuria	17 (94)	
Proteinuria ^b	10 (91)	
Positive blood culture ^c	1 (14)	Pregnancy
>10 ⁵ CFU of <i>S. typhi</i> /ml of urine	12 (67)	
Associated conditions		
Urolithiasis	3 (17)	Staghorn, multiple, ureteric
Bladder abnormality	3 (17)	BPH, tuberculosis, post-TUR
Renal	2 (11)	Lupus nephritis and posttransplant (both immunosuppressed)
Systemic	5 (28)	JRA, pregnancy, strongyloidosis, hypocalcemia following thyroidectomy, hepatitis

^a BPH, benign prostatic hypertrophy; TUR, transurethral resection of prostate; JRA, juvenile rheumatoid arthritis.

^b Not done for seven patients.

^c Done for seven patients only.

indicate local inflammation of the urinary tract. Microbiologically, *S. typhi* was isolated in large numbers from urine of all these patients. Therefore, it is logical to believe that the bacteriuria was due to local infection of the urinary tract by *S. typhi* in these 14 patients. This UTI could have resulted from a previous unrecognized blood infection, especially in patients with fever, although only one of six blood cultures in this group yielded *S. typhi*. For patients who are chronic carriers of *S. typhi*, developing an acute UTI due to the same organism is another possibility. Whatever the reasons, bacteriuria was the only manifestation of *S. typhi* infection in these patients, and the infection was diagnosed because of the investigations done for UTI.

The symptoms, as in earlier reports, were related mainly to the lower urinary tract (2–4, 10). Only three patients had abdominal pain. Fever, the most consistent feature of typhoid fever, was absent in five patients with dysuria. When fever was present, there was no specific pattern; duration also varied considerably.

In the four patients without symptoms of UTI, the bacteriuria could have been a transient, asymptomatic episode asso-

ciated with recent typhoid fever. Our finding of leukocyturia, proteinuria, and significant bacteriuria in all these patients suggests local infection, probably microabscess formation in the kidney (7), rather than pure excretion.

Conditions predisposing to this infection were also varied. In previous reports up to 50% of patients with *S. typhi* UTI had urinary calculi (8, 11). In contrast, calculi in our patients were proportionately low. Whether the systemic conditions we came across actually predisposed to *S. typhi* infection is not clear. One patient was diagnosed with strongyloidosis. Strongyloidosis is known to cause intermittent bacteremia, with intestinal bacteria being carried into the bloodstream during larval penetration of the intestinal wall (6). It is likely that *S. typhi* can also be carried thus, giving rise to intermittent high-grade fever.

Although *S. typhi* bacteriuria was asymptomatic and probably associated with recent typhoid fever in a few patients, the majority of the patients had symptomatic UTI. Fifty-six percent had single episodes of acute UTI. This condition occurred both in patients with local abnormalities of the urinary tract and in those without such abnormalities. However, patients who develop *S. typhi* bacteriuria should be evaluated carefully for urinary tract abnormalities. In our study most patients responded to appropriate medical therapy alone. Surgical intervention was required for patients with calculi. Whether intestinal parasitic infections can give rise to a chronic *S. typhi* infection, as with schistosomiasis, needs further investigation.

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