

Office Evaluation of Urinary Tract Infections in Elderly Women

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Urinary tract infection is common in elderly patients. Studies indicate that women aged over 65 years living at home have a 20 percent prevalence of urinary tract infections. Men aged 65 to 70 years living at home have a 2 to 4 percent prevalence of urinary tract infections, rising to 22 percent in those aged over 81 years, showing that the prevalence of urinary tract infections in men also rises with age, but approximately ten years later than in women. The overall prevalence of urinary tract infections in the elderly population living in residential homes is 25 percent and 33 to 35 percent for those in hospitals.¹⁻⁵ Thus, the prevalence of urinary tract infection increases with advancing age, diminishing mobility, and increasing degrees of institutionalization.¹⁻⁹ Recent evidence also reveals an increased morbidity and mortality as a result of bacteriuria.¹⁰⁻¹²

Diagnosis of urinary tract infections is traditionally based on a clean-catch urine culture. A positive culture is one that grows greater than or equal to 10⁵ organisms per milliliter of urine. There is an 80 percent probability of correctly identifying bacteriuria from a positive culture grown from one clean-catch urine specimen. Two specimens growing the same organism raise the probability to 95 percent, and three specimens growing the same organism raise the accuracy of diagnosing bacteriuria to nearly 100 percent.^{13,14} Urine cultures are considered the "gold standard" for diagnosing urinary tract infections. It is important that protocols for instructions, collection, transport, and plating are closely followed to avoid incorrectly identifying positive patients. Urine cultures, however, can

be time consuming (requiring 24 to 48 hours to produce a result) and expensive. Other available tests used to confirm or diagnose urinary tract infections include routine urine analysis, Gram staining, chemical analysis (including pH, specific gravity, protein, blood, glucose, ketones, bilirubin, leukocyte esterase, and nitrite), and dipslide culture of the urine. Differences in collection, handling and preparation, and urine concentration can affect the results.¹⁵⁻¹⁹

The physician must choose which tests are most reliable, cost effective, and efficient in diagnosing urinary tract infections in the elderly population. A study was conducted in an outpatient family practice clinic to determine the prevalence of urinary tract infection in elderly women and to study the sensitivity and specificity of a variety of tests when compared with the urine culture.

METHODS

Subjects were recruited from patients at the University of California Davis Medical Center (UCDMC) Family Practice Clinic. This clinic serves approximately 15,000 outpatients, of which 5 percent are women aged over 65 years. Female patients aged over 65 years presenting to the clinic for follow-up of nonacute illnesses (eg, arthritis and hypertension), asymptomatic for urinary tract infection, and meeting the exclusion criteria were asked to participate. Exclusion criteria included history of urinary tract infections, catheterization, urinary tract instrumentation, or surgery within the last three months, antibiotic usage within the last two weeks, and documented evidence of neurogenic bladder from any cause. Patients with diabetes mellitus or history of cerebrovascular accident with sequelae of urinary or fecal incontinence, dribbling, or altered micturition were excluded from the study. Other exclusion criteria included documented incontinence within the past three months, tabes dorsalis, or history of neurosyphilis, quadriple-

Continued on page 74

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TABLE 1. INDIVIDUAL LABORATORY TEST RESULTS FOR EIGHT PATIENTS (A-H) WITH ASYMPTOMATIC URINARY TRACT INFECTIONS AND NONINFECTED PATIENTS

Laboratory Test	Infected Patients								Noninfected Patients' Positive Results No. (%)	Total Patients' Positive Results No. (%)
	A	B	C	D	E	F	G	H		
Urine culture	+	+	+	+	+	+	+	+	0 (0)	8 (13)
Abnormal urinalysis	+	+	+	+	+	+	+	0	26 (47)	33 (52)
Urinalysis—	12-25	50-100	1-3	25-50	12-25	3-6	6-12	0	10 (18)	16 (25)
white blood cells (WBC/HPF)										
Urinalysis—	0	0	0	0	+	0	0	0	2 (4)	3 (5)
red blood cells										
Urinalysis—	+3	+4	+3	+3	+1	+3	+4	OCC	8 (15)	15 (24)
bacteria										
Gram stain—	+2	+4	+2	+4	0	+3	+3	+4	7 (13)	14 (22)
bacteria										
Gram stain—	0	+2	0	+2	0	0	+1	0	2 (4)	5 (8)
white blood cells										
Leukocyte esterase	0	+	0	+	+	0	+	0	7 (13)	11 (18)
Nitrite	0	+	+	0	0	+	0	0	5 (9)	8 (13)
Isocult	+	+	0	+	0	0	+	0	1 (2)	5 (8)

Continued from page 72

gia or lower extremity paraplegia, and present or history of systemic infection within three months.

No patient refused to enter the study, and 63 patients were enrolled. These patients completed a two-page questionnaire that elicited demographic information and a brief medical history. All laboratory analyses were performed without charge to the subjects. Subjects provided one clean-catch midstream urine specimen for analysis. Patients with abnormal results and their physicians were notified.

Collected specimens were immediately sent to the UCDMC laboratory to be analyzed by registered personnel according to protocol. Samples were divided into three aliquots and analyzed. One aliquot was cultured on MacConkey's agar and blood agar plates, and colony counts were performed 24 and 48 hours after plating. Routine urinalysis and chemical analysis were performed on the second aliquot. Ames N-Multistix strips were used to analyze the urine for protein, blood, glucose, and ketones. Leukocyte esterase and nitrite in the urine were detected with Chemstrip LN. Leukocyte esterase identifies the presence of white blood cells in the urine, even if the white blood cells have lysed as a result of improper handling. Nitrite in the urine indicates the presence of bacteria, as most pathogenic bacteria in the bladder convert nitrates to nitrite. In addition, 12 mL of urine were spun down and the sediment resuspended in 1 mL of saline solution. A drop of this suspension was then examined for erythrocytes, white blood cells, casts, crystals, epithelial cells, mucus, and bacteria. A Gram stain of one drop of unspun urine was also performed, and the number and type of bacteria present, as well as the

presence of any white blood cells, were recorded. The third aliquot was used to inoculate a two-sided dipslide containing MacConkey's agar on one side and plain agar on the other, which was then incubated for 12 to 18 hours. These SmithKline Isocult dipslides quantify bacteriuria, but do not identify the isolated organisms.

RESULTS

The mean age of the patients was 74 years, with a range of 65 to 92 years. Ninety-four percent were living at home or with relatives, while 6 percent were in senior citizen or public housing. None of the subjects resided in nursing homes or institutions.

Eight of 63 patients (13 percent) had positive urine cultures. The infectious agents were *Klebsiella* organisms (4), *Escherichia coli* (1), *Staphylococcus epidermidis* (1), diphtheroids (1), and mixed (1). The individual test results for each of the eight positive urine culture patients (A through H) are shown in Table 1. These patients were classified as having asymptomatic urinary tract infections. Also in Table 1 the number of positive tests for all the other patients in the noninfected group are indicated. Of the eight patients with asymptomatic urinary tract infections, all but one were positive for at least one half of the tests. One patient (H) was positive on only two tests. On the other hand, only three patients in the noninfected group were positive on three or more tests. The sensitivity and specificity of individual laboratory tests are outlined in Table 2. The urine culture result was used to define the disease state.

TABLE 2. PERCENTAGE OF SENSITIVITY AND SPECIFICITY OF INDIVIDUAL LABORATORY TESTS COMPARED TO URINE CULTURE STANDARD

Test	Sensitivity	Specificity
Abnormal urinalysis	88	53
Urinalysis—white blood cells	75	82
Urinalysis—red blood cells	13	96
Urinalysis—bacteria	88	86
Abnormal Gram stain	88	86
Gram stain—bacteria	88	87
Gram stain—white blood cells	38	96
Leukocyte esterase	50	87
Nitrite	38	91
Isocult	50	98

DISCUSSION

The prevalence of asymptomatic urinary tract infection in this sample of elderly women was 13 percent. This figure is similar to that of samples in other studies, though it may be lower than most, as only asymptomatic women were selected. Women with urinary tract infection symptoms or a recent (three-month) history of urinary tract infection were excluded. The sample was predominantly ambulatory and self-sufficient, thus correlating with a lower prevalence rate. As seen by these data, there is no one test that is sufficient to diagnose urinary tract infection in elderly patients. Patients identified as having urinary tract infection by the urine culture were usually positive on at least three other tests. As in other studies, pyuria ranged from none to 50 to 100 white blood cells per high-power field.^{7,9} Urinalysis alone identified 26 additional patients. The Isocult dipslide and nitrite results were disappointing, with only four and three, respectively, out of eight positive patients being properly identified. As expected, the rate of false-positive results for leukocyte esterase was high, identifying seven additional patients. Five of these patients also had white blood cells on urinalysis or Gram stain, suggesting an inflammatory process. In view of these results,

it would appear that in an office setting, routine urinalysis and Gram stain (for bacteria and white blood cells) are appropriate alternatives while awaiting urine culture results.

References

1. Carty M, Brocklehurst JC, Carty J: Bacteriuria and its correlates in old age. *Gerontology* 1981; 27:72-75
2. Kaye D: Urinary tract infections in the elderly. *Bull NY Acad Med* 1980; 56:209-220
3. Yoshikawa TT: Unique aspects of urinary tract infection in the geriatric population. *Gerontology* 1984; 30:339-344
4. Kurtz SB: Urinary tract infections in older persons. *Compr Ther* 1982; 8:54-57
5. Frye S, Melman A: Aspects of asymptomatic UTI in elderly patients. *Consultant* 1985; 15:51-52, 62-63
6. Brocklehurst JC, Dillane JB, Griffiths L, Fry J: The prevalence and symptomatology of urinary tract infection in an aged population. *Gerontol Clin* 1968; 10:242-253
7. Sourander LB: Urinary tract infection in the aged: An epidemiological study. *Ann Med Intern Fenniae* 1966; 55(suppl 45):7-55
8. Freedman LR: Urinary tract infections in the elderly. *N Engl J Med* 1983; 309:1451-1452
9. Heinamaki P, Haavisto M, Mattila K, Rajala S: Urinary characteristics and infection in the very aged. *Gerontology* 1984; 30:403-407
10. Dontas AS, Kasviki-Charvati P, Papanayiotou PC, Marketos SG: Bacteriuria and survival in old age. *N Engl J Med* 1981; 304:939-943
11. Dontas AS, Papanayiotou P, Marketos SG, Papanicolaou NT: The effect of bacteriuria on renal functional patterns in old age. *Clin Sci* 1968; 34:73-81
12. Dontas AS, Papanayiotou P, Marketos S, et al: Bacteriuria in old age. *Lancet* 1966; 2:305-306
13. Kunin C, DeGroot J: Self-screening for significant bacteriuria. *JAMA* 1975; 231:1349-1353
14. Stamey T: Diagnosis, localization, and classification of urinary infections. In Stamey T (ed): *Pathogenesis and Treatment of Urinary Tract Infections*. Baltimore, Williams & Wilkins, 1980
15. Holm S, Wahlin A, Wahlqvist L, et al: Urine microscopy as screening method for bacteriuria. *Acta Med Scand* 1982; 211:209-212
16. Mariani AJ, Luangphinit S, Loo S, et al: Dipstick chemical urinalysis: An accurate cost-effective screening test. *J Urol* 1984; 132:64-66
17. Shaw ST, Poon SY, Wong ET: Routine urinalysis: Is the dipstick enough? *JAMA* 1985; 253:1596-1600
18. Gillenwater JY: Detection of urinary leukocytes by Chemstrip-L. *J Urol* 1981; 125:383-384
19. Kusumi RK, Grover PJ, Kunin CM: Rapid detection of pyuria by leukocyte esterase activity. *JAMA* 1981; 245:1653-1655