

Accuracy of reagent strip testing for urinary tract infection in the elderly

P J Evans MD B R Leaker MD MRCP* W R McNabb MD R R Lewis FRCP
 Guy's Department of Geriatric and General Medicine, 3rd Floor, Hunt's House, London SE1 9RT

Keywords: urinary tract infection; reagent strip; elderly patients

Summary

The accuracy of reagent strip testing for urinary tract infection (UTI) was assessed in 100 elderly patients (50 acute patients admitted to hospital and 50 attending the day hospital). Reagent strip sensitivities were: acute patients - urinary nitrite 83%, blood 67%, protein 72% and leucocytes 72%, and day hospital patients - urinary nitrite 90%, blood 65%, protein 30% and leucocytes 60%. Urinary nitrite specificities were 100% for both groups of patients. Only 28% of patients with a UTI had specific symptoms of the infection; pyrexia and a raised WBC also proved poor indicators. Urinary nitrite was thus the most accurate immediate indicator of UTI.

Table 1. The accuracy of urinary nitrite, blood, protein (greater than 1+), and leucocytes (greater than 10/ μ l) together with urinary symptoms and pyrexia for the diagnosis of urinary tract infections in acutely ill elderly patients

	Sensitivity (%)	Specificity (%)
Nitrite	83	100
Blood	67	66
Protein	72	66
Urinary leucocytes	72	81
Symptoms	28	59
Pyrexial	22	84

Introduction

Urinary tract infection (UTI) increases in both sexes with advancing age and in the elderly at least 20% of women and 10% of men have significant bacteriuria¹⁻³. The prevalence of UTI in the elderly is greatest in long stay geriatric patients and least in those living at home^{1,4}. Most elderly people with a UTI have no pyrexia, leucocytosis or urinary symptoms⁵ and such infections may therefore be difficult to detect in this age group.

Three groups of elderly patients who have bacteriuria can be identified; those with classical symptoms of UTI (frequency, dysuria and haematuria), those who are asymptomatic (the majority) and those who present atypically with falls, immobility, confusion or poor general health. It is unnecessary to screen patients who have classical symptoms and there is little justification for screening elderly patients for asymptomatic bacteriuria since not only are they symptomless but survival is unaffected by treatment⁶⁻⁸. We believe the most suitable patients to be screened for UTI are those who are acutely ill presenting with the non-specific symptoms described above.

Reagent strip testing of urine is a method designed to allow early detection of infection and thus earlier initiation of treatment. The purpose of this study was to assess the accuracy of urine reagent strip testing for nitrite, blood, protein and urinary leucocytes for UTI detection in elderly patients.

Method

One hundred patients were studied as two groups; 50 consecutive acute admissions to the department

of geriatric medicine (32 women, 18 men; mean age 82 years; age range 65-94 years) and 50 consecutive new day hospital referrals (38 women, 12 men; mean age 80 years; age range 65-93). None of the patients studied had an indwelling bladder catheter. A fresh mid-stream specimen of urine (MSSU) was obtained from the acutely ill patients on admission to hospital and from the day hospital patients on their first day of attendance. One half of each urine sample was promptly sent to the laboratory for standard microscopy and culture and the other half was immediately reagent strip tested for nitrite, blood, protein greater than 1+ (N-LABSTIX, Ames) and a leucocyte count >10/ μ l (NEPHUR -TEST+LEUCO, Boehringer).

The MSSU was considered positive if the laboratory showed pathogenic organisms at over 10⁵/ml⁹.

Each acutely ill patient admitted to hospital was assessed for the presence of urinary symptoms (haematuria, dysuria and frequency) and pyrexia (temperature >37°C) during the first 24 h of admission.

Urinary reagent strip results together with the clinical information were compared with the laboratory results in terms of sensitivity and specificity. The sensitivity of each parameter was defined as the number of proven laboratory UTIs demonstrated by the parameter, expressed as a percentage of the total number of proven UTIs. The specificity of each parameter was the number of laboratory normal urines demonstrated by the parameter, expressed as a percentage of the total number of normal urines. A blood sample was collected for automated measurement of the peripheral white blood cell count.

Student's *t*-test for unpaired data was used to determine the significance of any difference between the peripheral white blood cell counts of patients with and without a laboratory proven UTI.

Correspondence to: Dr P J Evans, Department of Medicine for the Elderly, Ealing Hospital, Uxbridge Road, Southall UB1 3EW

*Present address: Department of Nephrology, Institute of Urology, UMCSM, University Street, London WC1E 6JJ

Table 2. The accuracy of urinary nitrite, blood, protein (greater than 1+) and leucocytes (greater than 10/ μ l) for the diagnosis of urinary tract infections in patients attending the day hospital

	Sensitivity (%)	Specificity (%)
Nitrite	90	100
Blood	65	83
Protein	30	87
Urinary leucocytes	60	87

Results

Of the 50 acutely ill patients admitted to hospital, 18 were found to have a UTI by the laboratory. Reagent strip sensitivities and specificities for urinary nitrite, blood, protein and leucocytes are shown in Table 1. The sensitivity and specificity of both urinary symptoms and pyrexia are also shown. Detection of nitrite gave the highest sensitivity (83%), with a specificity of 100%. Only 5 (28%) of patients who were acutely ill from a UTI had haematuria, dysuria or frequency of micturition. No significant difference in the peripheral white blood cell count was observed between patients with laboratory proven UTI ($7.86 \pm 4.93 \times 10^9/l$) and laboratory normal urine ($9.10 \pm 4.46 \times 10^9/l$).

Of the 50 day hospital patients, 20 were found to have a UTI proven by laboratory testing. Reagent strip sensitivities and specificities for urinary nitrite, blood, protein and leucocytes are shown in Table 2. The presence of urinary nitrite showed the highest sensitivity at 90%, with the specificity being 100%.

Discussion

The results show that of the parameters investigated urinary nitrite detection provided the greatest accuracy for diagnosing laboratory proven urinary tract infections in elderly patients, the sensitivity being 83-90% and the specificity 100%. Urinary leucocytes, blood and protein gave lower sensitivities than urinary nitrite, and the presence of urinary symptoms, pyrexia or a raised peripheral white blood cell count all proved to be poor indicators of UTI.

Patients with urine positive for nitrite can thus be prescribed antibiotics without delay whilst awaiting antibiotic sensitivities from the laboratory. Rapid diagnosis and treatment of UTI is likely to lead to earlier recovery and this could possibly either prevent admission to or allow an earlier discharge from hospital. It is important to note however that there was a false negative result of 10-17%, so that a negative nitrite test does not entirely exclude the presence of a urinary tract infection.

Ninety per cent of urinary pathogens are capable of converting urinary nitrate to nitrite providing there has been a sufficient time for incubation, that is more than three hours in the bladder before voiding. Thus

overnight samples have yielded a higher positive nitrite test than those taken later in the day¹⁰. Pathogens detected by this method include Gram negative bacilli and Group D streptococci (eg streptococcus faecalis). Of the 38 UTIs in this study, 29 were caused by Gram-negative bacilli, six were mixed organisms and three were due to *Staphylococcus epidermidis*. The nitrite test failed to detect five Gram negative infections (four *E. coli*, one *Proteus*).

None of the uninfected urines gave a positive test for nitrite. Immediate reagent strip testing has the advantage of reducing the uncertainty caused by the presence of contaminants acquired during or after collection of the urine sample. Further, patients with debris in the urine from an indwelling bladder catheter are likely to have a negative result unless an infection is present.

A considerable difference in urinary protein detection was observed between the acutely ill patients and those at the day hospital. In acutely ill patients there are a number of incidental causes of proteinuria, for example cardiac failure, and this is likely to account for the observed difference in urinary protein sensitivity.

In conclusion, reagent strip testing for urinary nitrite provides an immediate and reliable indicator for the presence of urinary tract infection in elderly patients.

References

- 1 Brocklehurst JC, Dillane JB, Griffiths L, Fry J. The prevalence and symptomatology of urine infection in an aged population. *Gerontol Clin* 1986;10:242-53
- 2 Kasviki-Charvati P, Drolette-Kefakis S, Papanayiotou PC. Bacteriuria in old age. *Age Ageing* 1982;11:169-74
- 3 Boscia JA, Kobasa WD, Knight RA, Abrutyn E, Levison ME, Kaye D. Epidemiology of bacteriuria in an elderly ambulatory population. *Am J Med* 1986;80:208-14
- 4 Sourander LB. Urinary tract infection in the aged - an epidemiological study. *Am Med Intern* 1966;55(suppl. 45):7-55
- 5 Boscia JA, Kobasa WD, Abrutyn E, Levison ME, Kaplan AM, Kaye D. Lack of association between bacteriuria and symptoms in the elderly. *Am J Med* 1986;81:979-82
- 6 Maclaren DM. Screening for bacteriuria in elderly people. *Lancet* 1989;ii:98-9
- 7 Heinämäki P, Haavisto M, Hakulinen T, Mattila K, Rajala S. Mortality in relation to urinary characteristics in the very aged. *Gerontology* 1986;32:167-71
- 8 Nordenstam GR, Brandberg CA, Oden AS, Eden CMS, Svanborg A. Bacteriuria and mortality in an elderly population. *N Engl J Med* 1986;314:1152-6
- 9 Kass EH. Bacteriuria and the diagnosis of infections of the Urinary Tract. *Arch Int Med* 1957;100:709-13
- 10 Czerwinski AW, Wilkerson RG, Merrill JA, Braden B, Comore P. Further evaluation of the Griess test to detect significant bacteriuria. *Am J Obstet Gynecol* 1971;110:677-81

(Accepted 26 February 1991)