Short reports

Routine urinalysis in renal transplant patients

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Abstract

The performance of two commercially available urine dipstick tests was evaluated to exclude significant bacteriuria in midstream urine samples from patients attending a renal transplant outpatient clinic. The use of dipsticks to reduce the necessity for routine microscopy and culture was also assessed. Consecutive urine samples (n=497) from 121 patients were examined for leucocytes, nitrite, and blood with Multistix* 10SG (Ames) and Nephur test (Boehring) dipsticks. All urine samples also underwent routine microscopy and culture. The sensitivities of the Nephur test and Multistix were 83% and 82%, respectively; the specificities were 28% and 40%, respectively; the negative predictive values were 85% and 88%, respectively; and the positive predictive values were 24% and 29%, respectively. Underlying conditions and treatments in renal patients may have led to relatively low sensitivity and positive predictive values. Traditional microscopy and culture methods are more reliable for renal transplant recipients.

(J Clin Pathol 1995;48:383-384)

Keywords: Urinalysis, microscopy, renal transplant screening.

Leucocytes and nitrite are well established indicators of urinary tract infections.¹ Rapid urine screening tests have been suggested to exclude significant bacteriuria in midstream urine (MSU) samples. If their sensitivity and specificity are sufficient this can reduce the laboratory cost of processing negative urine samples in different patient populations. We evaluated two commercially available dipsticks to test the urine from renal transplant patients at the St Helier Trust renal unit before sending them to the laboratory for routine bacteriology.

Methods

From 1 May 1992 to 26 July 1992, 497 consecutive urine samples were tested from 121 patients who had had renal transplants performed at the St Helier Trust renal unit. There were 75 males and 46 females, with a mean age of 47.75 years. Length of time after transplant ranged from one month to 13.75 years. Urine samples were tested in the renal unit by the research nurse and a microbiology medical laboratory scientific officer (MLSO).

All the urine samples were examined within one hour of receipt using Multistix*10SG (Ames) and Nephur test (Boehring) dipsticks for leucocytes, nitrite, and blood. The results were recorded according to the manufacturers' criteria for each dipstick. If one or more tests was positive they were regarded as giving a positive dipstick result (and suggestive of infected urine). If all three tests were negative they were regarded as negative.

All urine samples were then sent to the microbiology laboratory for routine microscopy and culture. Microscopy was performed using a microtitre tray and examined using an inverted microscope. The number of red and white blood cells seen in one field was recorded as number of cells/ μ l of urine. If no red or white cells were seen this was regarded as negative microscopy. (Any red or white cells seen were regarded as positive microscopy.)

Urine samples were cultured by charging a 3 mm standard loop with urine, inoculating 1/4 CLED (cystine-lactose-electrolyte deficient) agar plate, and incubating at 37°C overnight. Growth of <30 colonies was recorded as "No significant growth" and regarded as culture negative; 30-300 colonies were recorded as 10^7 organisms/litre and >300 colonies recorded as $>10^8$ organisms/litre: both were regarded as culture positive. Mixed growths of >30 colonies were also regarded as culture positive for this study.

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Accepted for publication
25 August 1994

Result of dipstick analysis

	No of urine samples	Sensitivity (%)	Specificity (%)	Positive predictive value (%)	Negative predictive value (%)	False positive (%)	False negative (%)
Multistix	497	81.6	39.7	28.7	87.9	46.47	4.2
Nephur	497	82.5	27.5	24.25	84.9	56.53	3.82

Results

Ninety nine urine samples were culture positive (19.92%): 21 grew coliform spp, 14 enterococci, four pseudomonas spp, 12 candida sp, 18 *Staphylococcus epidermidis*, 1 serratia sp, 1 group B Streptococcus, and 45 had a mixed growth.

Sensitivity, specificity, positive, and negative predictive values were assessed by comparing the stick test results for leucocytes and haemoglobin with the microscopy and the nitrite stick test.

The results are given in the table.

Discussion

Approximately 50 urine samples are sent each day from the renal unit at St Helier Trust Hospital to the clinical microbiology laboratory for routine examination. If reliable screening methods were available to eliminate negative urine samples the workload could be lightened, allowing more time and effort to be spent on positive ones, providing a more efficient and cost-effective service. Patients might also be trained to test their own urine samples at home.

The results showed a high rate of false positive values and therefore low specificity with both types of stick test. Red blood cells can lyse rapidly, resulting in negative microscopy. The stick tests are very sensitive, capable of detecting 5–10 intact red cells in both stick tests (Manufacturers' information).² Blood detection is based on the peroxidase like activity of haemoglobin which catalyses the reaction of an organic hydroperoxide with a chromagen.

The 4% false negatives and low positive predictive values in both sticks may have been due to the difficulty in approximately 10% of urine samples in distinguishing between negative and weak positive tests for leucocytes (which detect esterases in granulocytes). In those cases where the colour change was minimal the test was regarded as negative. Gross albuminuria and ketone containing urine samples diminish the reaction of the test, which may also account for low positive predictive values in some of the patients.

The nitrite detects the reduction of nitrites by some organisms, especially those of the *Enterobacteriaceae*; however, 40% of our isolates, for example, pseudomonas, enterococci, and candida, do not belong to the *Enterobacteriaceae* and may therefore have given a negative nitrite result.

Reports of the sensitivity, specificity and negative and positive predictive value of urine dipsticks vary. Gelbart and Prabhudesai³ found

a negative predictive value of 96% in symptomatic geriatric men using chemistrip LN, which detects only nitrite and leucocytes. This compares with only 85–86% for these two tests in the Nephur test and Multistix in our hands. Smith *et al.*⁴ considered a sensitivity of 85% to be unacceptable but a predictive value for negatives of 97% to be clinically useful. Our results showed lower sensitivity, at 81.6% and 82.5%, and negative predictive values of only 87.9% and 84.9%. Flanagan *et al.*⁵ found a high sensitivity of 98.3% using the nitrite and leucocyte test with the multistix and a negative predictive value of 94% in a population of geriatric males. Bank *et al.*⁶ discussed the problem associated with screening different patient populations; for example, urine specimens from females are more likely to give a false positive reaction due to contamination with vaginal epithelial cells. The isolates from the culture positive urine samples in our study cover a wide range of organisms, a large number of which may not be nitrite positive. This may have contributed to the low positive predictive values, together with the presence or absence of red and white blood cells, which may be influenced by underlying clinical conditions and treatment, particularly treatment with immunosuppressive agents. Renal transplant patients are probably more likely to have urinary abnormalities such as microscopic haematuria than the random population, contributing to the poor specificity of our results.

Our experience suggests it would not be advisable to allow patients to test their own urine, confirming conclusions made by Alwall *et al.*⁷

Although other studies have found urine dipsticks to be useful in certain patient populations we feel that traditional methods of microscopy and culture are more reliable for renal transplant patients.

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