Predictive Value of Urine Microscopy in Urinary Tract Infections

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Dear Sir,

Both conventional and simplified urine culture methods have the disadvantage of requiring 18-24 h of incubation before the result is available. Rapid detection of significant bacteriuria is particularly useful when life-threatening generalized sepsis is suspected to arise from the urinary tract. This would allow prompt and appropriate antimicrobial treatment. In general practice, attendances for symptoms suggesting acute urinary tract infection are relatively frequent. 50% of women complaining of symptoms of urinary infection have been reported to have true bacterial infection, whereas the remainder are suspected to have nonspecific urethritis [1]. Most general practitioners do not use urine cultures (or appropriate substitutes) to diagnose urinary tract infection.

Microscopy of fresh, unspun urine is one routine procedure used in some clinics and has proven to be an aid to detection of bacteriuria in children [2]. In order to evaluate the reliability of such a procedure in situations where the expected percentages of significant bacteriuria is high, we compared urine microscopy with the conventional pour-plate method on a series of patients at high risk of urinary tract infection. From February 1977 to January 1978, 165 urine specimens were obtained from 140 females and 25 males (120 outpatients attending our urinary tract infection clinic and 45 patients admitted to our general hospital because of various urological diseases). All patients were given careful spoken instructions for collection of their clean voided midstream urine specimen. Only 30 specimens were collected by single urethral catheterization or from an indwelling catheter. In all cases, the urines were allowed to stay in the bladder for at least 4 h. 48 patients were on antimicrobial therapy at the time of urine collection, whereas all the others had not been taking any antimicrobial drugs for at least 7 days. Each specimen was immediately processed (normally within 30 min of collection, in all cases no later than 1 h). All urines were cultured in nutrient agar using the standard pour-plate method at dilutions of 10^{-1} and 10^{-3} . All the 165 urine specimens were evaluated by microscopy: a drop of well-mixed, unspun urine was placed on a slide, covered with a cover slip and examined with high dry lens (400 ×) for bacteria, white cells and red cells. 20 randomly selected fields were searched under reduced light. The number of bacteria was expressed as 1+ (few) when the rods seen by microscope ranged from at least 2/20 fields to 3/field, or 2+ (many) when more than 10 rods/field were detected. Leukocyturia and hematuria were defined > 5 WBC/20 fields and > 1 RBC/20 fields, respectively. Urines were considered infected when more than 105 colony-forming units (CFU)/ml urine of a single organism were recovered on culture by the pour-plate method.

77 urines were found to be infected according to the mentioned criterion. 60 of these showed more than 106 colonies/ml urine on culture. The causative isolates of infected urines were

Escherichia coli 35%, *Pseudomonas aeruginosa* 15%, *Proteus* species 21%, *Enterobacter* 13%, *Klebsiella* 8%, gram-positive cocci 7%.

The relationship between the results of urine microscopy and those of the conventional pour-plate method is given in figure 1. Many or few bacteria were seen in 63 of 77 patients with proven urinary tract infection ($> 10^5$ CFU/ml). Our urine microscopy method showed a sensitivity of 81.8% and correctly identified 83 of 88 non-infected urines (specificity: 94.3%). Many or few bacteria were seen under the microscope on 68 urine specimens and 63 of these were found to be

0-10⁵ 10⁵-10⁶ 10⁶-10⁷
or greater

Bacteria per milliliter urine

Fig. 1. Correlation of quantitative bacterial counts (pour-plate method) with bacteria seen by microscope in 165 unspun urines.

0 = No bacteria seen; 1+ = few bacteria (2/20 fields to 3/field); 2+ = many bacteria (> 10 /field).

infected (positive predictive value: 92.6%). Significantly, of the same 68 urines, 36 showing many bacteria under the microscope were all found to be infected. Of the 97 urine specimens that did not show microscopic bacteriuria, 83 were not infected (negative predictive value: 85.8%). 5 urine specimens showed microscopic bacteriuria but were not infected; these urines were from patients on antimicrobial therapy. Leukocyturia was detected in 55 of 77 (71.4%) of the infected urines and in 14 of 88 (14.8%) of noninfected urines.

Kunin [3] reported that urinary bacteria (1 or more per field) could be easily identified by microscopy in unspun urine, only when present at a concentration of 10^6 /ml or greater.

However, in our study we also found that the presence of at least 2 bacteria in 20 randomly selected high-power fields, correlates well with the presence of significant bacteriuria ($> 10^5$ CFU/ml urine). In addition, bacterial counts in most cases of our urinary tract infections, were ranging from 10^6 to 10^7 /ml.

In conclusion, we would emphasize that: (1) microscopic examination of fresh unspun urine is reliable and simple to perform both in clinical laboratories and physician's practices and (2) the detection of microscopical bacteriuria with our method has a high positive predictive value in selected groups of patients, in which a high prevalence of urinary tract infections is expected on clinical grounds.

References

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