

Diagnosis of Urinary Tract Infection - Validity of Rapid Quantitative Unspun Urine Microscopy

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ABSTRACT

Introduction: Urinary tract infections (UTIs) are among the most common bacterial infections and account for a significant part of the workload in clinical microbiology laboratories. However, the diagnosis of UTI is not always straightforward. Urine culture is considered as gold standard for diagnosis of UTI but it is time consuming and laborious. Leucocytes in the urine demonstrate inflammation and tissue invasion of the UTI, distinguishing infection from colonization or contamination. Therefore, pyuria can be used as an indicator of bacteriuria. This retrospective study was conducted to assess the usefulness of quantitative unspun urine microscopic examination for the rapid diagnosis of urinary tract infections.

Material and Methods: The present retrospective study was conducted at Guru Gobind Singh Medical College and Hospital, Faridkot. For this, clean catch, midstream urine samples were collected in sterile, wide mouthed, universal container from 2299 patients clinically suspected of UTI. The specimens were immediately transported to the laboratory and processed within 2 hours of the collection. Semi quantitative culture was done on blood agar and Mac Conkey agar and colonies were counted after overnight incubation at 37°C. Cut off for significant bacteriuria was taken as 10⁵cfu/ml. Quantitative uncentrifuged wet mount microscopic examination was done of well mixed uncentrifuged urine sample and a drop of which was examined under high power field of microscope for the presence of pus cells. The cut off for significant finding was ≥1pus cell /7hpf for pyuria.

Results: A total of 2299 urine samples of patients were tested. Out of which, 861 (37.5%) had pus cells on wet microscopic examination while 754 (32.8%) had growth on semi quantitative culture of urine. Correlation of microscopic examination of urine with urine culture showed Sensitivity: 92.7%, Specificity: 89.5%, PPV (Positive predictive value): 81.1%, NPV (Negative predictive value): 96.2%

Conclusion: Quantitative uncentrifuged wet microscopy of urine is a rapid, reliable valuable time saving and cost effective technique which could be added into routine laboratory practice for faster diagnosis of UTIs.

Keywords: Urinary Tract Infection (UTIs), Urine Microscopy, Bacteriuria, Pyuria, Urine Culture

which include wet mount microscopy, gram stain, dipstick and automated assays. However, all these tests are reported to have variable efficacy and validity.^{4,7} Therefore, this retrospective study was conducted to evaluate the usefulness of quantitative unspun urine microscopy as a rapid diagnostic tool which could be used in primary health care centres for early diagnosis of UTI.

MATERIAL AND METHODS

The present retrospective study was conducted at Guru Gobind Singh Medical College, Faridkot.

Sample collection

For this, clean catch, midstream urine samples (MSU) were collected in sterile, wide mouthed, universal containers from 2299 consecutive patients clinically suspected to have UTI. The specimens were immediately transported to the laboratory and processed within two hours of the collection.

Culture

Semi quantitative cultures were done on blood agar and Mac Conkey agar and colonies were counted after overnight incubation at 37 C. Cut off for significant bacteriuria was taken as 10⁵ cfu/ml.³ Samples showing growth of 2 or more bacterial species of doubtful significance were noted and repeat cultures were asked for. MSU samples showing scanty bacterial growth were reported as bacterial growth of no significance.

Quantitative unspun wet mount microscopic examination

Quantitative unspun wet mount microscopic examination was done for the well mixed uncentrifuged urine sample. 50µl of urine sample was placed on clean grease free glass slide and covered with 20mm*20mm coverslip and was examined under high power field of microscope for the presence of pus cells. The cut off for the significant finding was 1 pus cell / 7 high power fields (hpf) for pyuria.³

STATISTICAL ANALYSIS

Microsoft office 2007 was used for statistical analysis. Mean and percentages were used to represent the data.

RESULTS

A total of 2299 urine samples collected from the same number

INTRODUCTION

Urinary tract infections (UTIs) are one of the major cause of morbidity and mortality, especially in hospitalised patients. These infections may result in serious urological problems (cystitis, prostatitis, pyelonephritis etc.) and chronic renal failure.^{1,2} The challenging fact about the UTIs is that their diagnosis is not always straightforward. Quantitative urine culture is the standard procedure for the diagnosis of UTIs.³ However, this procedure is time consuming, laborious and cannot be performed in resource compromised and underprivileged health care setups. Many rapid diagnostic tests are now available to diagnose UTIs

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of patients of clinically suspected UTI were tested. Quantitative unspun wet mount microscopy showed the presence of pus cells in 861 (37.5%) samples while significant bacteriuria by semi quantitative culture of urine was seen in 754 (32.8%) samples. Correlation of microscopic examination of urine with culture of urine specimens has been depicted in Table 1. Considering urine culture as gold standard test, the sensitivity, specificity, PPV (Positive Predictive value), NPV (Negative predictive value) of wet mount microscopy was found to be 92.7%, 89.5%, 81.1% and 96.2% respectively.

DISCUSSION

While urine culture is considered to be a gold standard for the diagnosis of urinary tract infections, its limitations have resulted in the use of many rapid diagnostic tests for the early diagnosis of UTI.^{4,7} Microscopic examination of urine is done principally to detect the presence of polymorphonuclear leucocytes in urine which is an indicator of infection of the urinary tract. In the present study, we evaluated quantitative unspun urine microscopy for significant pyuria for rapid diagnosis of UTI keeping semi quantitative culture of urine as standard.

In this study, quantitative unspun urine microscopy was found to be a sensitive and specific test for the diagnosis of UTIs as it showed the sensitivity of 92.7% and specificity of 89.5% (Table 1). The test also showed high negative predictive value of 96.2% which helped in screening out negative samples with high degree of confidence. During the period of the study, its use also helped to facilitate the diagnosis of two cases of renal tuberculosis. The urine samples of these two patients were repeatedly giving negative result on culture but the samples showed the presence of large no of pus cells and RBCs on microscopic examination. One of the urine sample was ultimately found to be positive for the growth of *Mycobacterium tuberculosis* on LJ medium, thus confirming the diagnosis of renal tuberculosis.

Taneja et al studied the validity of number of rapid tests like quantitative unspun urine microscopy, dipstick test leucocyte esterase and nitrite test and obtained best results by combining the microscopy with dipstick test. They also observed that the sensitivity and specificity of rapid tests increases with the concomitant use of any three screening tests.⁶ Cardoso et al (1998) employed microscopic examination of uncentrifuged gram stained urine for the detection of UTI and reported that this method was no better in comparison to the microscopic examination of unspun urine drop for detection of significant bacteriuria and pyuria.⁷

For urine culture, the specimen must be properly collected before antimicrobial treatment is started and information regarding previous therapy must be obtained.³ We observed that majority of our patients were already on antimicrobial therapy when they submitted urine samples for culture. This resulted in failure to get significant bacterial growth on culture, thus missing the diagnosis of UTI. Under such circumstances, microscopy plays a vital role in the diagnosis of UTI, as pyuria is the best indicator of active infection of urinary tract.

As 70-80% of urine specimens received in clinical laboratory are found to be free from evidence of UTI³, use of this simple test (to demonstrate pyuria) could help to identify and eliminate these normal specimens and help them being reported as showing no evidence of infection without further delay. Thus

| Microscopic ^c pyuria | Number of urine cultures ^b | | |
|------------------------------------|---------------------------------------|----------|-------|
| | Positive ^a | Negative | Total |
| Positive | 699 (a) | 162(b) | 861 |
| Negative | 55 (c) | 1383(d) | 1438 |
| Total | 754 | 1545 | 2299 |

^aSensitivity [a/ (a + c)] = 699/754 (92.7%). Specificity [d/ (b + d)] = 1383/1545 (89.5%), Positive predictive value [a/ (a + b)] = 699/861 (81.1%), Negative predictive value [d/ (d + c)] = 1383/1438 (96.2%). ^bColony counts of $\geq 10^5$ CFU/ml., ^cObservation of ≥ 1 pus cell per 7 high power fields

Table-1: Correlation between microscopic examination and culture results of 2299 urine specimens

rapid diagnostic test could help to screen out negative samples and save valuable time and money.

Since the presence of leucocytes in the urine indicates inflammation and tissue invasion of the urinary tract, demonstration of pyuria also helps to distinguish infection from colonisation and contamination. Stamm valued pyuria as single best indicator of bacteriuria that resolves with antimicrobial therapy and suggested that if pyuria is absent, antimicrobial therapy is not indicated.^{8,9} Another important advantage of urine microscopy is that it doesn't cost more than Re.1.00 as against Rs.100.00 for urine culture and sensitivity. Thus, this test could be easily conducted in the resource compromised laboratories in primary health care setups as routine test and as a screening test in high end laboratories.

However, this quantitative urine microscopy may give misleading results if the test is performed cursorily or on the centrifuged deposit of the urine. Some polymorphonuclear leucocytes are usually present in the urine of healthy, uninfected persons and it is only if their number is clearly greater than the normal values, the presence of pus cells is indicative of UTI.⁵ Another limitation of the test is that the tubular epithelial cells, present in cases of pyelonephritis and other kidney diseases, may be confused with leucocytes and which may give false positive results.

It can thus be concluded that quantitative uncentrifuged urine microscopy is a rapid, reliable, valuable and cost effective technique which could be added as a routine laboratory test for quick diagnosis of UTI. This would help in the timely treatment of UTI thus decreasing morbidity and mortality due to UTIs.

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