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Correlation of Bacteriuria, Pyuria with Urine Culture in Symptomatic UTI Patients; a Study from a Tertiary Care Center in North India

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ABSTRACT

Although culture is the gold standard for diagnosis of urinary tract infections (UTI), microscopy of well mixed drop of urine and several different dipstick rapid tests have become popular over the years, as culture is expensive, time consuming and requires a well-established microbiological laboratory and technical expertise. Rapid screening is also required in special circumstances, not only where it is difficult to identify urinary tract infection (UTI) on basis of clinical criteria alone but also where early diagnosis and prevention of complications affords significant benefit. This prospective cross sectional study was carried out in the Department of Microbiology of Government Medical College, Srinagar. A total of 800 patients were taken up for the study. Samples following the inclusion criteria were included in the study. Gram staining, wet mount for detection of pus cells and urine culture was performed. Data was compiled and compared with culture as gold standard for diagnosis of UTI.

Results: wet mount examination for detection of pyuria was done on all 800 samples taken up for study which gave sensitivity, specificity, positive predictive value, negative predictive value of 75%, 55%, 37.14%, 86.32% respectively when compared to conventional culture. Gram staining for detection of bacteriuria was also done on all 800 samples and showed sensitivity, specificity, positive predictive value, negative predictive value of 90%, 89%, 74.51%, and 96.17% in comparison to culture.

Conclusion: Although urine culture is used as the reference standard to determine the presence or absence of urinary tract infection (UTI), but it is an expensive and time consuming method. Substituting rapid diagnostic tests for a hospital laboratory urine analysis may be less time consuming and less expensive.

Keywords: Bacteriuria, Pyuria, PPV of bacteriuria and pyuria, UTI, Rapid screening of UTI.

INTRODUCTION

The term urinary tract infection encompasses a variety of clinical entities, including asymptomatic bacteriuria (ASB), cystitis, prostatitis, and pyelonephritis [(1)]. Both urinary tract infection (UTI) and asymptomatic bacteriuria (ASB) denote the presence of bacteria in the urinary tract, usually accompanied by white blood cells and inflammatory cells in the urine[(2)]. Bacteriuria is a frequently used term that denotes the presence of bacteria in urine. The probability of the presence of bacteriuria can be ascertained by quantifying the number of bacteria in voided urine or in urine obtained via urethral catheterization. Significant bacteriuria is a term used to describe the number of bacteria in voided urine that usually exceeds the

number caused by contamination from the anterior urethra (i.e., $\geq 10^5$ bacteria/ml). The implication being that in the presence of at least 10^5 bacteria/ml of urine, infection must be considered as UTI [(3)]. However studies of women with symptoms of cystitis have found that a colony count threshold of $\geq 10^2$ bacteria/mL is more sensitive (95%) and specific (85%) than a threshold of 10^5/mL for the diagnosis of acute cystitis in women.

Clinically, UTIs are categorized as uncomplicated or complicated. Uncomplicated UTIs typically affect individuals who are otherwise healthy and have no structural or neurological urinary tract abnormalities. Complicated UTIs are defined as UTIs associated with factors that compromise the urinary tract or host defense, including urinary obstruction, urinary retention caused by neurological disease, immunosuppression, renal failure, renal transplantation, pregnancy and the presence of foreign bodies such as calculi, indwelling catheters or other drainage devices[(4&5).] In general, infection in men, pregnant women, children, and patients who are hospitalized or in health care associated settings may be considered complicated. Complicated urinary tract infections (UTIs) are generally caused by multidrug resistant organisms. Some consider upper urinary tract infection as complicated [(6&7)]. Urinary tract infections (UTIs) can recur in the form of relapses or re-infections. Although culture is the gold standard for diagnosis of urinary tract infections (UTI), microscopy of well mixed drop of urine and several different dipstick rapid tests have become popular over the years, as culture is expensive, time consuming and requires a well-established microbiological laboratory and technical expertise[(3)].Rapid screening is also required in special circumstances, not only where it is difficult to identify urinary tract infection (UTI) on basis of clinical criteria alone but also where early diagnosis and prevention of complications affords significant benefit (e.g. pregnant women, children, and post renal transplant patients)[(8)]. Pyuria may be defined as 8 leukocytes/mm^3, using a hematocytomer from a clean catch mid-stream specimen is the hallmark of inflammation, and the presence of Polymorphonuclear Neutrophils (PMNs) can be detected and enumerated in un-centrifuged specimens [(9)].

Screening tests are useful adjuncts to culture in diagnosing complicated UTI [(10,11)]. Timely detection of urinary tract infections (UTIs) is essential to institute early treatment as delay can lead to significant morbidity and mortality [(12)].

MATERIAL AND METHOD

This prospective cross sectional study was carried out in the Department of Microbiology of Government Medical College, Srinagar. A total of 800 patients were taken up for the study. The samples were selected randomly from the urine specimen received in the laboratory for urine culture and sensitivity. Hospitalized patients (IPD), Patients above the age of 2 years with suspected urinary tract infection, catheterized patients, patients who had undergone surgical instrumentation and patients on antibiotics were included in the study. Samples which were taken by following techniques: Suprapubic aspiration, Percutaneous nephrostomy (PCN aspirate), Cystoscopy and Ileal conduit were excluded from the study.

Patients were advised to collect the midstream clean catch urine by voiding the first portion in a sterile, wide mouth, screw capped bottle after very thorough preliminary cleaning of external genitalia with soap and water. For Hospitalized patients with indwelling catheter Staff was advised to clamp off the catheter tubing above the port to allow the collection of freshly voided urine. The catheter port or wall of the tubing was then asked to be cleaned vigorously with 70% ethanol, and urine aspirated via a needle and syringe; it was advised to maintain the integrity of the closed drainage system to prevent the introduction of organisms into the bladder. Urine was transported to the laboratory as soon as possible. It was cultured as early as

possible after collection, preferably within 2 hours. In case of delay, it was advised to be refrigerated up to a maximum of 24 hours, as bacterial counts in refrigerated (4°C) urine remain constant for as long as 24 hours. If delay was expected to be for more than 24 hours then use of transport media (Urine transport tubes containing boric acid, sodium borate, and sodium formate) was advised.

Approximately 2 ml of well mixed, un-centrifuged urine specimen was transferred using a sterile Pasteur pipette into a labeled tube, and one-drop of urine was placed on a clean grease free glass slide using the same pipette without spreading. It was allowed to dry (air dry or on a dryer), heat fixed and stained by Gram stain. The specimen tubes were then placed in the refrigerator till plating and there after stored at 2-8ºC until the final report was sent. Smear was then examined under oil immersion (1000x). The presence of 1 or 5 bacteria per oil immersion field (OIF) which is suggestive of significant bacteriuria. All the specimens were also examined microscopically for pyuria. Urine was examined directly under microscope for pus cells. A count of more than 8 pus cells per high power field (hpf) was considered as pyuria. The specimen tubes were then placed in the refrigerator till plating and there after stored at 2-8ºC until the final report was sent.

For Culture the urine was plated on 5% sheep blood agar plate and a MacConkey agar plate following the SOP of our laboratory. Plates were incubated aerobically at 35-37°C for at 18-24 hours. The characteristic colony character and colony count were taken into consideration. The organism was later confirmed using conventional biochemical techniques after doing gram-staining. The number of bacteria were estimated by counting the number of colonies on the surface of the media. One colony = 1,000 cfu/mL ($1x10^3$ cfu/ml) when we take .001 ml of urine and when a larger volume of urine i.e. .01ml is used one colony = 100 cfu/ml ($1x10^2$ cfu/ml). If there was a pure growth of 10-100 or over 100 colonies, the isolate was sub cultured for identification and antimicrobial susceptibility testing. For cultures that contained two organisms, one in low numbers (<100 colonies) and the other over 100 colonies, then only the predominant organism was sub cultured. If both are present at over 100 colonies, both organisms were sub cultured. If more than two organisms were isolated, then further processing was not done since this is highly likely to be a contaminated specimen. Antimicrobial susceptibility testing was performed using the Kirby-Bauer disk diffusion method according to Clinical and Laboratory Standards Institute (CLSI). [13]

RESULT

Table 1: Results of Urine Culture

Culture	Frequency	Percent (%)
Positive	208	26 %
Negative	592	74 %
Total	800	100 %

Table 2: Wet Mount versus Culture

		Culture			PPV	NPV
		Positive	Negative	Total		
WM	Positive	156	264	420	37.14%	86.32%
	Negative	52	328	380		
	Total	208	592	800		
Sensitivity 75% Specificity 55%						

Table 3: Gram Staining Versus Culture

		Culture			PPV	NPV
		Positive	Negative	Total		
GS	Positive	187	64	251	74.51%	96.17%
	Negative	21	528	549		
	Total	208	592	800		
Sensitivity 90% Specificity 89%						

DISCUSSION

In our study wet mount examination for detection of pyuria was done on all 800 samples taken up for study which gave sensitivity, specificity, positive predictive value, negative predictive value of 75%, 55%, 37.14%, 86.32% respectively when compared to conventional culture. Similar observations were noted by N Taneja et al[14] where sensitivity, specificity, positive predictive value, negative predictive value of microscopic pyuria was 89.7%, 49.6%, 33.7%, 94.4% respectively. However, this is at variance with the study of Ratna Baral et al[15] who reported sensitivity, specificity, positive predictive value, negative predictive value of microscopic pyuria as 36%, 60%, 67% and 55% respectively, also Mustafa et al[16] reported that detection of pyuria had low accuracy compared to dipstick tests. This difference may be due to delayed transportation of specimen, which affects presence of pus cells in urine or degree of pyuria. However in our study all urine specimens were processed within 2 hours which reflected as good results from wet mount examination. Gram staining for detection of bacteriuria was also done on all 800 samples and showed sensitivity, specificity, positive predictive value, negative predictive value of 90%, 89%, 74.51%, and 96.17% in comparison to culture, these findings are supported by data given in literature which states that the presence of at least one organism per oil-immersion field (OIF) in uncentrifuged urine had a sensitivity of 94% and a specificity of 90% for detecting colony counts of at least 10^5 CFU/mL on culture [17]. Although urine culture is used as the reference standard to determine the presence or absence of urinary tract infection (UTI), but it is an expensive and time consuming method. Substituting rapid diagnostic tests for a hospital laboratory urine analysis may be less time consuming and less expensive [18].

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Ethical Approval: Approved

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