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Detection of Pyuria versus Bacteriuria in Suspected Patients of Urinary Tract Infection

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Abstract
Urinary tract infection (UTI) is one of the most important causes of mortality and morbidity in the world affecting all age groups across the life span. The aim of this study is to determine incidence of bacteriuria and its relation with pyuria in suspected urinary tract infection. This crosssectional-descriptive-analytical study was conducted in microbiology section of Kathmandu Hospital, Tripureshwor from May to August 2011. During this period, 412 mid-stream urine samples collected were investigated by microscopic examination of centrifuged urine sediment and conventional semi-quantitative culture technique. Out of 412 MSU samples, 120 (29.13%) were culture positive. The remaining 22 (18.33%) samples showed low count significant bacteriuria (i.e 10^4-10^5 CFU/ml) and 98(81.67%) showed significant bacteriuria (i.e. $\geq 10^5$ CFU/ml). Among 88 urine samples with significant pyuria, only 74 (84.09%) showed culture positive. Out of 324 urine samples without significant pyuria, 46 (14.19%) urine samples showed culture positive result. Significant pyuria was found to have sensitivity of 61.67%, specificity of 95.21% and the test has 84.09% positive predictive value in detecting bacteriuria. Pyuria and bacteriuria may not always correlate in the suspected case of UTI.

Key words: pyuria, bacteriuria, urinary tract infection, culture

Introduction
Urinary tract infection is the most important cause of mortality and morbidity in the world affecting all age groups across the life span (Basnet *et al.* 2009). It is estimated that 150 million cases of UTI occur on a global basis per year resulting in more than 4 billion pounds (6 billion dollars) in direct health care expenditure (Kucheria *et al.* 2005). According to the annual report published by Department of Health Services (2059/60), morbidity of UTI in Nepal is 1,25,058. Nepalese patients attending general hospitals ranged from 23.1% to 37.4% (Rai *et al.* 2008).

Urinary tract infections are a spectrum of diseases caused by microbial invasion of the genitourinary tract that extends from the renal cortex of the kidney to the urethral meatus (Mahon *et al.* 2007). The presence of pyuria and bacteriuria are two most important indicators of urinary tract infections (Douri 2008). Bacteriuria is defined as the presence of $>10^5$ colonies of a single pathogen per milliliter of urine (Celen *et al.* 2011). A more current definition is the presence of as few as 10^3 CFUs/ml in symptomatic patients or when a specimen is obtained by sterile catherization (Baum and Heintz 2008). Pyuria is defined as the presence of white blood cells (WBCs) in a person's urine (Adegoke *et al.* 2011).

Bacteriuria without pyuria may occur in cases of asymptomatic patient with diabetes, enteric fever or bacterial endocarditis or during pregnancy (Kattel *et al.* 2009). Pyuria with a sterile routine culture may be found with renal tuberculosis, gonococcal urethritis, *C. trachomatis* infections and leptospirosis (Cheesbrough 2006). Pyuria can occur in the absence of apparent bacterial infection, particularly in patients who have already taken antimicrobials, calculus

disease, stricture, neoplasm and glomerulo-nephropathy. In female patients, pyuria can occur due to leucorrhea, fever, pregnancy and administration of adrenocortical steroids without infection (Santos *et al.* 2007). This study was conducted to determine the incidence of bacteriuria and relationship between pyuria and bacteriuria.

Methodology

A crossectional-descriptive-analytical study was carried out at bacteriology laboratory of Kathmandu hospital, Tripureshwor during May 2011 to August 2011 of suspected UTI patients (both outpatient and inpatient) visiting Kathmandu Hospital. Four hundred and twelve clean catch mid-stream urine samples were collected from patients for urine routine test and culture. The samples were collected and processed by standard bacteriology method. Ten ml of urine sample was taken in a clean sterile centrifuge tube and centrifuged at 3000 rpm for 10 min. The supernatant was discarded. The sediment was then examined for presence of the pus cells by wet mount preparation. The pus cells >5/HPF were considered as significant. The samples were subjected to standard bacterial culture of Blood and MacConkey agar plates according to the standard laboratory methods (Procedures/ Guidelines for the Microbiology Laboratory 2010). The plates were observed for bacterial growth after 18 hours incubation at 37^0C aerobically. The bacteria were identified by colony characters, Gram's reaction and biochemical properties. Bacterial colonies more than 10^5 colony forming units per ml of urine were considered as significant. Chi-square test was done wherever applicable with a P value <0.05 regarded as significant.

Results and Discussion

Out of 412 urine samples, 221 were from females and 191 were from males. Of the total samples, 22 (5.34%) samples showed low count significant bacteriuria and 98(23.79%) showed significant bacteriuria (Fig. 1).

Among 412 urine samples, 88(21.36%) showed significant pyuria, 69(16.75%) showed insignificant pyuria and 255 (61.89%) had no pus cells.

Out of 88(100%) samples with significant pyuria, 74 (84.09%) were culture positive, while 46 (14.19%) out of 324 (100%) with no significant pyuria were culture positive. The test had sensitivity, specificity, positive and negative predictive values of 61.67%, 95.21%, 84.09% and 85.80% respectively. Pyuria and bacteriuria were correlated statistically (P<0.05) (Table 1).

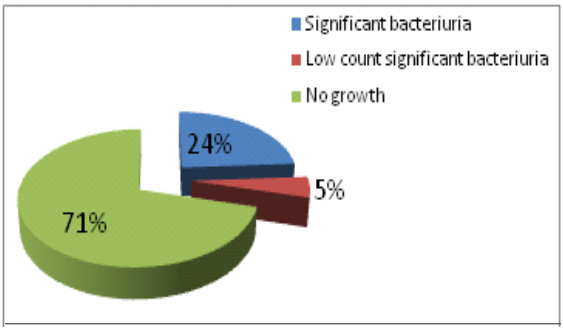

Fig. 1. Pattern of urine culture results

Table 1. Correlation of pyuria with culture result

Pyuria	Culture positive (%)	Culture negative (%)	Total (%)
Significant (>5WBC/HPF)	74 (84.09)	14(15.9)	88(21.35)
No significant pyuria (≤5WBC/HPF)	46(14.19)	278(85.8)	324(78.64)
Total	120(29.13)	292(70.87)	412 (100)

As shown in Table 2, 28 samples out of 29 having 6-10 pus/HPF in microscopy were culture positive. When infections were analyzed by the organisms causing infection, 61.21 percent infection caused by Gram negative Bacilli, 66.67% by Staphylococci and single isolate of Streptococci were accompanied with significant pyuria (Table 3).

Table 2. Pyuriaversus Bacteriuria

Pus cells /HPF	No of samples	Culture positive (%)	Culture negative (%)
0	255	31(12.16)	224(87.84)
1-5	69	15(21.74)	54(78.26)
6-10	29	28(96.55)	1(3.45)
11-20	25	18(72)	7(28)
21-50	21	19(90.48)	2(9.52)
>50	13	9(69.23)	4(30.77)
Total	412	120(29.13)	292(70.87)

Table 3. Bacterial agents in significant and insignificantpyuria

Bacterial agents	Significant pyuria (%)	Insignificant pyuria (%)	No pyuria (%)	Total
E. coli	60(62.5)	13(13.54)	23(23.96)	96
K. pneumoniae	4(50)	1(12.5)	3(37.5)	8
K. oxytoca	1(25)	1(25)	2(50)	4
P. vulgaris	1(50)	0(0)	1(50)	2
P. aeruginosa	3(100)	0(0)	0(0)	3
C. freundii	2(66.67)	0(0)	1(33.33)	3
S. aureus	0(0)	1(100)	0(0)	1
S. saprophyticus	2(100)	0(0)	0(0)	2
S. faecalis	1(100)	0(0)	0(0)	1

This study showed the relationship between pyuria and bacteriuria from suspected patients in Kathmandu Hospital. In this study, overall 23.79% urine samples showed significant bacteriuria. Similar results were also found by other investigators (Acharya *et al*. 2011, Basnet *et al.* 2009, Shrestha *et al*. 2007). The low rate of growth positivity might be due to inclusion of patients under treatment, infection due to slow growing organisms or due to those organisms that were not able to grow on the routine culture media used (Khanal 2006). About five and half (22/120) of samples showing 10^4-10^5 CFU/ml were considered low count significant bacteriuria because the patients were either diabetic, under antibiotic treatment, specimen were taken from catheter or suspected case of acute urethral syndrome.

In this study, 84.09% (74/88) samples with significant pyuria showed culture positive result. In a similar study conducted by Kattel *et al.* (2009), 53.9% urine samples showed significant bacterial growth with significant pyuria. The correlation between pyuria and bacteriuria was found to be statistically significant ($P<0.05$). As mentioned in earlier text, bacteriuria without significant pyuriaoften occur in cases of asymptomatic patients, patients with diabetes, enteric fever or bacterial endocarditis whereas significant pyuria with sterile bacterial culture occur in patients with prior antibiotic use, renal tuberculosis, corticosteroid administration, analgesic nephropathy, renal calculi or in the presence of bacteria that are not able to grow in the media used Kattel *et al.* (2009).

In this study, significant pyuriawas found to have sensitivity of 61.67% and specificity of 95.21%. Similar result was found in the study done by Khattak *et al*. (2003). The test had 84.09% positive predictive value and 85.80% negative predictive value. The high percentage of sensitivity and low percentage of specificity had also been reported (Kattel *et al.* 2009).

In present study, the significant bacterial growth was found to be high (96.55%) in samples with 6-10 pus cells per HPF which agrees the statement by Dhakal *et al.*(2002) that the presence of 5-10 pus cells per HPF could be a good marker of UTI.''

When infections were analyzed by the organisms causing infection, 61.21% infection caused by Gram negative *Bacilli*, 66.67% by *Staphylococci* and single isolate of *Streptococci* were accompanied with significant pyuria. But Tambyah and Maki (2000) in catheterized patients, found infections caused by Gram negative *Bacilli* were mostly accompanied with pyuria than coagulase negative *Staphylococci*, *Enterococci* or yeasts.

The majority of suspected patients may not have culture positive. Although pyuria and bacteriuria may not always correlate in the suspected cases of UTI, as the number of pus cells in urine increases, the chance of getting culture positive results is also high. Pyuria having low sensitivity for bacteriuria culture positive cases and low specificity for culture negative cases cannot be used as the sole criterion for the diagnosis of UTI. Hence, urine culture remains the standard method for the diagnosis of UTI.

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