

# Pyuria as a Screening Test for Detection of Urinary Tract Infection in Patients on Long-term Hemodialysis

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**Introduction.** This study was conducted to evaluate the sensitivity and specificity of pyuria detection in centrifuged urine samples of patients on hemodialysis, and its relationship with urinary tract infection.

**Materials and Methods.** Clean-catch midstream urine samples of 90 hemodialysis patients (34 women and 56 men) were obtained and divided into two parts for examination of urine sediment and urine culture. Pyuria was defined as the presence of more than 10 leukocytes per high-power field of microscope.

**Results.** Ninety patients with a mean age of  $52.8 \pm 14.2$  and a mean period of dialysis of  $3.3 \pm 2.3$  years were studied. Forty-five participants had pyuria and only 16 (35.5%) of them had a positive urine culture for infection. Pyuria and urinary tract infection were present in 52.9% and 29.4% of the women and 48.2% and 10.7% of the men, respectively. The sensitivity and specificity of pyuria screening for urinary tract infection was 100% and 61.8%, respectively. The positive and negative predictive values were 35.5% and 100%, respectively.

**Conclusions.** In patients on hemodialysis, because of the low specificity and positive predictive values, samples with positive pyuria should be cultured to confirm urinary tract infections.

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## INTRODUCTION

Infectious diseases are a major cause of mortality and morbidity among patients receiving hemodialysis. Previous studies have shown urinary tract infection (UTI) is the second cause of hospitalization of patient with chronic kidney failure, after pneumonia. Urinary tract infection is an important cause of mortality and morbidity in patient on hemodialysis. In the absence of normal urinary output, common symptoms of UTI including dysuria, frequency, and urgency are reduced or may be absent. Therefore, early diagnosis of UTI is necessary to prevent subsequent complications of UTI such as sepsis, nephrectomy, and death.<sup>1-5</sup>

Since the immune function of patients on maintenance hemodialysis is suppressed, they may be susceptible to infectious diseases. Therefore, any method that can detect infection in the early stage of disease is valuable. Urine culture is the gold standard for detection of UTI, but this method is expensive and time consuming. Pyuria, usually defined as a presence of more than 5 leukocytes per high-power field (HPF) of microscope, has shown a sensitivity and a specificity about 70% and 80%, respectively, for detection of UTI.<sup>6-8</sup> The aim of the present study is to assess pyuria as a rapid and inexpensive method to detect UTI in this group of patients.

## MATERIALS AND METHODS

### Study Population

This cross-sectional study was conducted with the aim of evaluation of the sensitivity and specificity of urine sediment method as a screening test to identify UTI in patients on hemodialysis. All patients who were receiving hemodialysis in 2 dialysis centers where eligible to be enrolled if they were older than 18 years, were on hemodialysis for more than 1 month, and had a urinary output more than 30 mL between two dialysis sessions. Patients who had an infectious disease or were on medications inducing pyuria were excluded. A written consent was obtained from all participants.

### Laboratory Studies

A clean-catch midstream urine sample was taken from each subject and was divided into 2 parts. One part was cultured for 24 hours, and cultured samples with more than 100 000 colonies per one milliliter of urine sample were considered positive. To obtain urine sediment from the second part of the sample, 12 mL of the fresh voided urine was centrifuged for 10 minutes with 2500 rpm, and the supernatant part was outpoured. The sediment was transferred to a clean slid and then observed by the HPF of microscope. A cutoff of 10 leukocytes per HPF was considered positive (as used by most studies that evaluated the role of pyuria in these patients).<sup>9</sup>

### Statistical Analyses

Data entry and management were performed on the SPSS software (Statistical Package for the Social Sciences, version 13.0, SPSS Inc, Chicago, Ill, USA). The accuracy of pyuria for detection of UTI was assessed by calculation of its sensitivity, specificity, positive predictive value, and negative predictive value against urine culture results.

## RESULTS

In this study, 90 of 170 patients who were on maintenance hemodialysis met the inclusion criteria and participated in the study (Table). The mean age of the participants was  $52.8 \pm 14.2$  years (range, 25 to 84 years). The mean duration of dialysis was  $3.3 \pm 2.3$  years. The underlying disorder was diabetes mellitus in 46 patients (51.1%) and hypertension in 18 (20.0%).

Pyuria was seen in the urine sample of 45

Baseline Characteristics of Participants

Characteristic	Value
Number of patients	90
Mean age, y	$52.8 \pm 14.2$
Female patients	
Percent	37.7
Mean hemodialysis duration, mo	$49.8 \pm 13.8$
Mean age at dialysis initiation, y	$53.3 \pm 14.3$
Male patients	
Percent	62.3
Mean hemodialysis duration, mo	$39.0 \pm 25.7$
Mean age at dialysis initiation, y	$49.8 \pm 13.0$
Underlying disorder, %	
Diabetes mellitus	51.1
Hypertension	20.0
Glomerulonephritis	12.0
Others	15.9

patients (50.0%), and 16 (17.8%) had a positive urine culture for UTI. All patients with documented UTI had pyuria. Therefore, pyuria had a sensitivity of 100% and a specificity of 61.8%. The positive and negative predictive values were 35.5% and 100%, respectively. Pyuria and urinary tract infection were seen in 52.9% and 29.4% of the women and in 48.2% and 10.7% of the men, respectively. Those patients who were younger than 50 years old showed a greater specificity, compared to the older (68.0% versus 54.0%).

## DISCUSSION

In this study, we evaluated the relationship between the presence of pyuria and UTI in patients on maintenance hemodialysis. Fifty percent of the participants had a positive pyuria, and urine cultures of 35.5% of them were positive. This result is consistent with previous studies that concluded pyuria was not “a good marker for UTI detection.”<sup>11-13</sup> Although pyuria had a sensitivity and a negative predictive value of 100%, the specificity and positive predictive value were not favorable. The prevalence of pyuria was 50.0%, which is somewhat similar to previous reports.<sup>9</sup> In the present study, different underlying disorders had relatively comparable sensitivities and specificities (data are not presented).

The link between pyuria and UTI has been evaluated and results has been controversial.<sup>9</sup> Cabaluna and associates were the first group that studied the relationship between pyuria and UTI in patients on hemodialysis.<sup>10</sup> Saitoh and colleagues

evaluated 182 patients on hemodialysis and found pyuria (defined as the presence of more than 10 leukocytes per HPF) in urine samples of 38% of patients, only 27% of whom had positive culture.<sup>11</sup> In a similar study, Hyodo and coworkers compared 75 patients on hemodialysis with 133 healthy volunteers.<sup>12</sup> The authors reported leukocyte counts increased with the decrease of urinary output and stated that pyuria was not a good marker for UTI detection in patients on hemodialysis. In addition, Eisinger and colleagues assessed the prevalence of pyuria and UTI in patients with chronic kidney disease. They observed only 1 of 9 patients with a positive pyuria who had a positive culture. They concluded that pyuria was not a suitable marker for detection of UTI.<sup>13</sup>

Recently, Vij and coworkers evaluated different cutoff values of pyuria (more than 5, 10, 50, and 100 leukocytes per HPF) and their relations with UTI. The specificity of pyuria increased with the increased cutoff value, while sensitivity decreased. They reported that different pyuria cutoff did not seem to have enough sensitivity and specificity to be used as a detecting test for UTI.<sup>14</sup> In contrast, one study<sup>15</sup> reported that pyuria was a good marker for detection of UTI; the authors showed that 70% of patients with a positive pyuria had a positive culture. In this study, only patients with a urinary output of more than 300 mL/d were included; as a result, it was likely that excluded patients with lower urinary output had a different pattern of UTI; therefore, the results of their may not be applicable for all patients on hemodialysis.

## CONCLUSIONS

Although a positive sample for pyuria had high sensitivity and negative predictive value, the low positive predictive value and specificity do not allow elimination of the need for urine culturing. We recommend that samples with positive pyuria be cultured to confirm UTI.

## CONFLICT OF INTEREST

None declared.

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