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URINARY PROTEIN CREATININE INDEX IN PATIENTS WITH URINARY TRACT INFECTION

Biochemistry

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ABSTRACT

Background: Urinary tract infection (UTI) is defined as the presence of microbial pathogens in the urinary tract with associated symptoms. In urinary tract infection, proteins are qualitatively non-detectable in urine. Raised excretion of proteins could be detected by measuring proteins in 24-hour urine. There are problems in collection of 24-hour urine sample. As an alternative, urinary protein to creatinine index (PCI) has been devised to detect minor proteinuria in random urine samples.

Aim: The aim of the study was to assess whether urinary PCI can be used to detect minor proteinuria in patients with urinary tract infection.

Material and Methods: Twenty five patients with UTI who fulfilled the criteria comprised the study group and twenty-five age matched healthy subjects were taken as a control group. Spot urine samples for quantifying urinary PCI were obtained. Sulfosalicylic acid method was used to estimate urinary protein. The modified Jaffe's method was employed to estimate urinary creatinine. The urine protein: creatinine index was calculated by dividing the urine protein concentration (mg/L) by urine creatinine concentration (mmol/L) multiplied by 10.

Results: Protein: creatinine index was found to be significantly higher in UTI (680+168.41) as compared to the control group (201.21+28.37). Qualitative tests for patients were negative in all UTI patients.

Conclusion: The results show that random urinary PCI can be a good indicator of proteinuria in UTI patients. This test could be a reasonable alternative to 24-hour urine sample collection for the detection of proteinuria in UTI patients.

KEYWORDS

UTI, Protein Creatinine Index, Microproteinuria

INTRODUCTION

The second most common infection found in community medical practice is urinary tract infection (UTI), which is defined as the presence of microbial pathogens in the urinary tract with associated symptoms [1]. UTI may occur as cystitis or pyelonephritis which may be uncomplicated and complicated [2]. Normally, nephrons remove waste products from the blood so that body can excrete them in the urine. Large molecules such as red blood cells and proteins stay in the blood. When nephrons are damaged, albumin and other proteins can enter glomerular filtrate and can come into urine. Therefore, the presence of protein in urine is abnormal [3].

Proteinuria is defined as urinary excretion of 300 mg or more protein in 24 hours [3] whereas excretion of 30-300 mg of protein in 24 hours is known as microproteinuria (microalbuminuria) [4, 5, 6]. Presence of proteins in urine is routinely detected by qualitative chemical tests for proteins or dipsticks [7]. In UTI, proteins are not detectable in urine by qualitative methods [3]. Some indirect methods for quantitative excretion of proteins are: calculation of protein-to-creatinine ratio, calculation of albumin –to- creatinine ratio and urinary protein creatinine index in random urine samples [8].These ratios are based on the fact that the creatinine excretion remains fairly invariable in the presence of a stable glomerular filteration rate (GFR) which removes the variations in urinary protein concentration during the day [3].

Microproteinuria which is qualitatively undetectable can be detected by measuring proteins in 24 –hr urine but there are problems with the collection of 24 –hr urine such as incomplete collection. Conversely, all ratio-based methods to detect microproteinuria use random urine sample. The urinary Protein Creatinine Index (PCI) has been devised as a simpler alternative based on the fact that creatinine excretion is fairly constant in any subject over a 24 hour period and it correlates well with the 24 hour total excretion of protein [9].

Though frank proteinuria doesn't occur in UTI, urinary protein excretion may be raised above normal. Therefore, the present study was undertaken to measure urinary PCI in spot urine in UTI to find out whether urinary protein excretion is raised in patients with UTI and to what extent.

MATERIALAND METHODS

The study was conducted on fifty subjects who were divided into a control group of 25 healthy subjects from the general population and 25 age and sex-matched patients with UTI. The patients fulfilled the diagnostic criteria of UTI i.e the presence of more than 100,000 colonies in a single urine culture. Patients suffering from Diabetes mellitus, glomerulonephropathy, persistent hematuria, prostatitis and pregnant women were excluded. Untimed midstream urine samples were taken in sterile containers from all subjects for urinary PCI estimations.

Urinary protein concentration was measured colorimetrically by sulphosalicylic acid method[10]. Urinary creatinine concentration was measured by the modified Jaffe's method in 1 in 50 with diluted urine samples [11]. Urinary PCI was calculated as described by Shaw et al. using the equation [9].

$$PCI = [Urinary\ protein\ (mg/L)/Urinary\ creatinine\ (mM/L)] \times 10$$

The data were expressed as mean ± SD. Data of test and control group were compared by unpaired Student's t-test. A p value less than 0.05 was considered as statistically significant.

RESULTS

Table 1 shows that urine creatinine concentration in test group and control group was comparable. The urinary protein of the test group (614.80± 198.30 mg/L) was found to be significantly higher than that of the control group (254.00±31.09 mg/L). Urinary PCI was significantly higher in UTI patients (680.96 ± 168.41) as compared to the control group (201.21± 28.37).

Table -1 Comparison of biochemical parameters (Mean ± SD) between control (Healthy) and test (UTI patients) group

Parameter	Control (n=25)	Urinary tract infection (n=25)	P value
Urinary protein(mg/L)	254.00±31.09	614.80±198.30	<0.001**
Urinary Creatinine(mmol/L)	12.71±1.24	9.06±1.86	>0.05*
PCI	201.21±28.37	680.96±168.41	<0.001**

* Non significant ** Significant

Figure: 1 Urinary Protein Creatinine Index in control and UTI group.
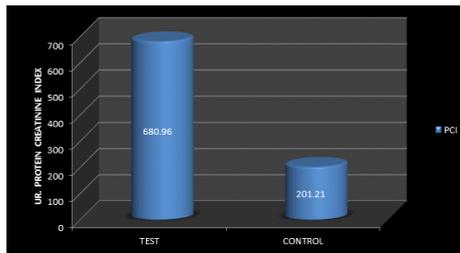
DISCUSSION:

Frank proteinuria is uncommon in UTI while the relationship between microalbuminuria and UTI remains uncertain [3]. For quantification of albuminuria or proteinuria, protein/albumin excretion in 24- hour urine is considered as "gold standard" but it is time consuming and inconvenient with poor patients compliance [12]. Measurement of PCI in a random urine sample is independent of errors in urine collection and correlates well with proteinuria in various diseases [13,14,15]. Therefore, we assessed the role of urinary PCI to find out whether the urinary protein is raised in patients with UTI and to what extent.

In the present study, the mean urinary protein concentration and PCI were found to be significantly higher in patients suffering from urinary tract infection as compared to the control group while creatinine excretion in these two groups was comparable. This means that increased PCI was due to increased protein excretion in UTI patients. Mohkam et al also observed proteinuria with high frequency during infection and pyelonephritis due to inflammation in proximal tubules which causes excretion of tubular proteins and proteinuria has been encountered in about 95% of cases in an acute phase of UTI [16].

Byung et al concluded that spot urine microalbumin/creatinine ratio in children with UTI was significantly greater than that in normal children, and it was positively correlated with GFR. They suggested that the ratio is a potential prescreening and prognostic marker in UTI patients [17]. Price et al. reviewed a number of studies and suggested that the P:C ratio can predict the amount of protein excreted in urine [18].

Our results confirm that urinary protein excretion increases in UTI even when proteins are qualitatively undetectable in urine. PCI can be a useful tool to detect microproteinuria.

CONCLUSION:

The present study suggests that PCI in a random urine sample can be a good predictor of protein excretion in UTI patients. Being simple and economical, this test could be used as an alternative to 24- hour urine sample analysis for detecting proteinuria. Since creatinine excretion is different in different populations, it is necessary to establish a reference range in each population to predict the extent of proteinuria.

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