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Original Research Article

Role of procalcitonin and C-reactive protein in urinary tract infection diagnosis in adults

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ABSTRACT

Background: Urinary tract infections are a common group of infections encountered in adults, and their treatment and prognosis are closely correlated with the location of infection. Clinical presentation and laboratory tests are insufficient to differentiate between upper urinary tract infection and lower urinary tract infection. So this study was conducted to explore a non-invasive diagnostic method for upper and lower urinary tract infection differentiation.
Methods: A case-control study included 2 groups of patients –30 cases and 30 controls. Cases further classified into 2 groups- a) Patients having upper urinary tract infection; b) Patients having lower urinary tract infection. Patients were subjected to following tests – complete hemogram, blood C-reactive protein levels, serum procalcitonin levels, urinalysis, ultrasound abdomen.
Results: Procalcitonin (PCT) and CRP values with upper urinary tract infection were significantly higher than those in with lower urinary tract infection. PCT has higher -sensitivity and a specificity than CRP.
Conclusions: Both procalcitonin and CRP can be used for upper and lower urinary tract infection differentiation, but Procalcitonin has higher sensitivity and specificity in predicting Upper urinary tract infection than CRP.

Keywords: CRP, Procalcitonin, Urinary tract infection

INTRODUCTION

In urinary tract infection differentiation between upper and lower urinary tract infections is required because of therapeutic and prognostic consequences. Various diagnostic approaches like clinical history, physical examination, urine analysis are often inconclusive. Differentiating between these is necessary because pyelonephritis can affect renal parenchyma and lead to renal scar formation, as well as high blood pressure and end stage renal failure in adults.[1,2] Specific investigations like serum antibodies against bacteria ACB assay (antibody coated bacteria in urine, bladder washout test, gallium scans, definitely contribute to localization of urinary tract infection but they are invasive and time consuming, hence cannot be used routinely. Indirect practical and non-invasive tests of localizing urinary tract infection into upper and lower tract has been described, such important method include serum procalcitonin and blood C- reactive protein.[3,4]

Procalcitonin (PCT) is a type of hormonal activity-free calcitonin precursor protein that can serve as an early diagnosis index of serious bacterial infections and sepsis.[5,6] C-reactive protein is an acute phase reactant produced in liver.[7] We analyzed the diagnostic value of PCT in differentiating upper and lower UTIs, and the

serum PCT level was determined and compared with C-reactive protein (CRP).[8]

METHODS

The study was conducted in 30 symptomatic, urine culture and sensitivity positive, but free from other diseases that may increase C-reactive protein levels, in patients above 18 years of age. Thirty apparently healthy, age and sex matched individuals free from diseases that can raise C-reactive protein were taken as control group. Urinary tract infection above the urinary bladder was considered as upper urinary tract infection, and below that as lower urinary tract infection. Patients were categorized into upper and lower urinary tract infection based on clinical features. Those with dysuria, discomfort, frequency, urgency and were categorised as having lower urinary tract infection (LUTI), while temperature more or equal to 38.5°C with loin pain or renal angle tenderness were categorised as having upper urinary tract infection (UUTI). The following investigations were carried out in both study and control groups.

- Complete hemogram
- Urine analysis and culture sensitivity
- Serum procalcitonin levels
- Plasma C-reactive protein levels: quantitative estimation
- Abdominal and pelvis ultrasonography

Inclusion criteria: Patients with all three urine samples showing $>10^5$ organisms/ml were included. Clean catch midstream urine samples with proper instructions were considered.

Exclusion criteria: Patients with inflammatory conditions other than UTI, history of trauma, pregnancy, USG proven renal calculi.

RESULTS

Out of total 30 cases with urinary tract infection, 17 (56.66%) cases were females and rest 13 (43.33%) cases were males. Out of total 30 cases of urinary tract infection, 11 were of upper urinary tract infection, and 19 were of lower urinary tract infection on the basis of clinical features. The PCT and CRP values with upper urinary tract infection were significantly higher than those in with lower urinary tract infection (Table 1). Procalcitonin had higher sensitivity, specificity, positive predictive value and negative predictive value in predicting upper urinary tract infection than CRP (Table 2).

Table 1: Comparison of the laboratory outcomes between groups.

Group	N	PCT (ng/ml)	CRP (mg/l)	Significance
UUTI	11	3.56±1.17	116.9±9.89	P<0.001
LUTI	19	0.98±0.39	14.5±7.1	P<0.05
Control	30	0.23±0.11	2.4±1.3	

Table 2: Comparison of diagnostic values of procalcitonin and CRP.

	Diagnostic reference value	Sensitivity	Specificity	Positive predictive value	Negative predictive value
PCT	1ng/ml	90.1%	86.3%	86.3%	88.9%
CRP	20mg/l	85.7%	51.4%	58.1%	80.2%

DISCUSSION

In UTI differentiation between upper and lower urinary tract infection has diagnostic and prognostic significance. The distinction is very important because renal parenchymal involvement can cause parenchymal scarring that may lead to arterial hypertension and chronic renal failure. This study was done to evaluate the role of procalcitonin and C-reactive protein in upper urinary tract infection and lower urinary tract infection.[9,10]

Procalcitonin (PCT) is a type of hormonal activity-free calcitonin precursor protein and its value upto 1ng/ml were taken as normal. C-reactive protein is an acute phase reactant produced in liver Mean value of procalcitonin in upper urinary tract infection was 3.56 ng/ml and lower urinary tract infection was 0.98ng/ml. In control group, it was 0.23 ng/ml.

In this study serum C- reactive protein value of upto 5mg/L was taken as normal. Mean value of C-reactive protein in upper urinary tract infection was 116.9 mg/L and lower urinary tract infection was 14.5 mg/L. In control group C-reactive protein value in between the normal range i.e. 0-5 mg/L.[11]

This shows that procalcitonin and C-reactive protein is significantly raised in upper urinary tract infection and can be used as markers to differentiate between upper urinary tract infection and lower urinary tract infection. Very few studies are done in adult patients.

CONCLUSION

Serum Procalcitonin and Blood CRP estimation in UTI are non-invasive and specific tests to differentiate between upper urinary tract infection and lower urinary tract infection. Procalcitonin has higher sensitivity and specificity in predicting Upper urinary tract infection than CRP. Procalcitonin is highly stable in serum and its values is not affected by inflammatory conditions unlike CRP so is a better tool than CRP.

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