EVALUATION OF URINARY PROTEIN TO CREATININE RATIO AS A PREDICTOR OF END-STAGE RENAL DISEASE

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ABSTRACT

Objective: *To evaluate the role of urinary protein to creatinine (P:C) ratio as a predictor of end-stage renal disease (ESRD) in renal failure patients.*

Material and Methods: *This study was conducted at Liaquat National Medical College & Hospital, Karachi from Jan-Dec 2006 on 121 patients (77 males, 44 females) with acute renal failure (ARF) & chronic renal failure (CRF). Clinical history, relevant investigations, renal status, dialysis routine and frequency were recorded. Random Urine samples (single void) were collected and the P:C ratio were calculated.*

Results: *Out of 121 patients, 21 patients developed ESRD including 16 males (12 CRF, 4 ARF) and 5 females (all CRF). Statistical analyses shows no significant difference between sum of P:C ratio of CRF and ARF patients. However moderate significance ($P < 0.05$) was noted among P:C ratio of ESRD patients when compared with males CRF and ARF groups. Similarly, female groups also showed non-significant difference, whereas ESRD patients (FC_{ES}), depicts moderate ($P < 0.05$) significance when compared with female CRF and ARF groups. P:C ratio of males and females ESRD groups showed no significance difference. Mean P:C ratio in male CRF end stage category was 4.12 ± 0.82 (range 2.5 – 9.1) where as in male ARF end stage 3.78 ± 1.67 (range 1.80- 7.12). Mean P:C ratio in female CRF end stage category was 3.94 ± 0.79 (range 1.76 – 5.98).*

Conclusion: *Patients with P:C ratio of > 1.0 has developed ESRD. Higher the ratio of P:C, the more was risk of deterioration of clinical condition.*

Key words: *Protein to Creatinine Ratio, End-Stage Renal Disease, ESRD, Chronic Renal Failure, CRF, Acute Renal Failure, ARF*

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INTRODUCTION

It is known that proteinuria is a major determinant of progression of renal disease[1]. Recent studies have shown that proteinuria itself causes further tubular injury and thus can perpetuate further damage[2,3]. Subsequently, clinical manifestations of renal disease are divided into well- defined syndromes such as nephrotic syndrome, acute renal failure (ARF) and chronic renal failure (CRF)[4-6]. The former is characterized by heavy proteinuria, whereas later two groups are characterized by azotemia and prolonged onset of uremia and azotemia, respectively[1,7,8]. Furthermore, it is known that CRF that leads to severe illness and required some form of renal replacement therapy (such as dialysis) is called end stage renal disease (ESRD). Moreover, in certain condition, such as nephrotic syndrome, chronic renal failure and acute renal failure, the amount of protein excretion is a reflection of activity of disease leading to ESRD[9-11]. Moreover, it has been observed that in patients with chronic proteinuric nephropathies, the ratio of protein to creatinine predicted the rate of decline in GFR and the progression to ESRD[12,13]. Studies have shown that patients with a urinary protein:creatinine (P:C) ratio of less than 1.0 had a slow rate of renal abnormalities with no ESRD where as those with a ratio of 1.0 or greater than 1.0 had decrease in GFR and a higher risk of ESRD.

This study was conducted to evaluate the role of urinary protein to creatinine (P:C) ratio in diagnosed CRF and ARF patients, as a predictor of end-stage renal disease (ESRD).

MATERIAL AND METHODS

Patients: 121 patients (77 males, 44 females) aged 50 to 81 years, were included in the study. They were grouped according to gender, type of renal disease and

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evaluation of ESRD. Clinical history, with related lab diagnoses, renal status, dialysis routine and frequency were taken and logged for assessment. 30 healthy individuals (15 each of males and females) were also included in the study.

Study Period: Jan 2006 to Dec 2006.

Sampling: Random Urine samples (single void) from patients admitted in wards, visiting OPDs or labs for routine checkup or tests were collected in sterilized bottles and immediately analyzed for creatinine and protein.

Analysis: Urinary protein (Reference range < 12.00 mg/dl) and creatinine (Reference range 30-260 mg/dl) were analyzed on automated chemistry analyzer 912 (Roche Diagnostics, Basel) with full calibration and both PNU and PPU controls (Roche Diagnostics, Basel). All samples were divided into three aliquots and analyzed. The protein/creatinine ratio were calculated and compared with healthy individuals.

Statistical analysis: Data was analyzed statistically with significance level of P > 0.01 using SSP (version 10) software.

Data presentation: Data is presented in the form of percent onset for clinical stages and numerical figures in P:C values for clarity.

RESULTS

A total of 121 patients; 77 males (63.6%), and 44 females (36.36%) aged 50 to 81 years, were tested for P: C ratio in the study (Fig 1). Out of 121 patients, 21 patients developed ESRD including 16 males (12 CRF, 4 ARF) and 5 females (all CRF).

In male group (n = 77), 49.3% (n = 38) were in CRF category and 50.64% (n = 39) were in ARF. Out of CRF category (n = 38), 12 (31.57%) were diagnosed with ESRD designated as MC_{ES} (Fig 2). History reveals the onset of CRF in 6 patients for more than 4 years and in 4 patients for more than 3 years. All MC_{ES} were undergoing dialysis with a frequency of one per week. In ARF category (n = 39) (Fig 2), 4 (10.25%) were diagnosed with ESRD and designated as MA_{ES}. All were diagnosed with ARF since last three years. Dialysis frequency was one after every 15 days (two per months).

In female group (n = 44), 44.45% (n = 20) (Fig 3) were in CRF category and 54.54% (n = 24) were in ARF. In CRF category (n = 20), 5 (25.0%) (Fig 3) were diagnosed with ESRD designated as FC_{ES}. History reveals the onset of CRF in these 5 patients for more than 3 years. All FC_{ES} were undergoing dialysis with a frequency of one per week. In ARF category (n = 24), none of the patients were diagnosed with ESRD.

Statistical analyses shows no significant difference between sum of P:C of CRF and ARF patients. However moderate significance (P < 0.05) was noted among P:C

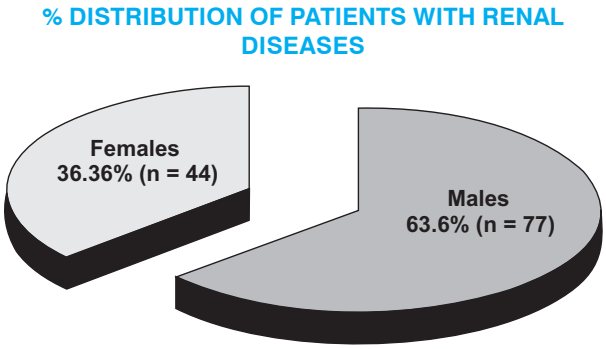

Fig. 1

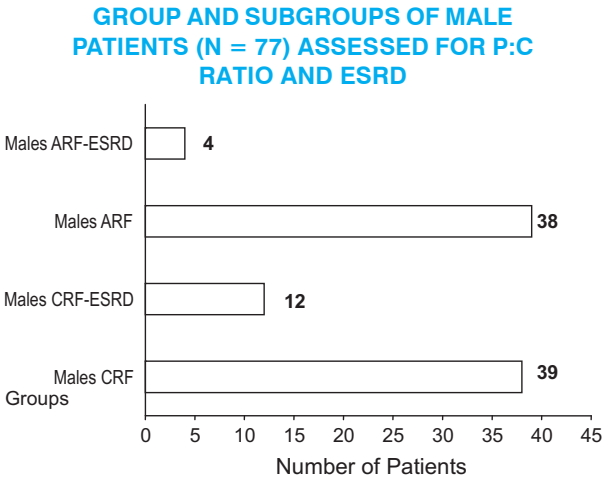

Fig. 2

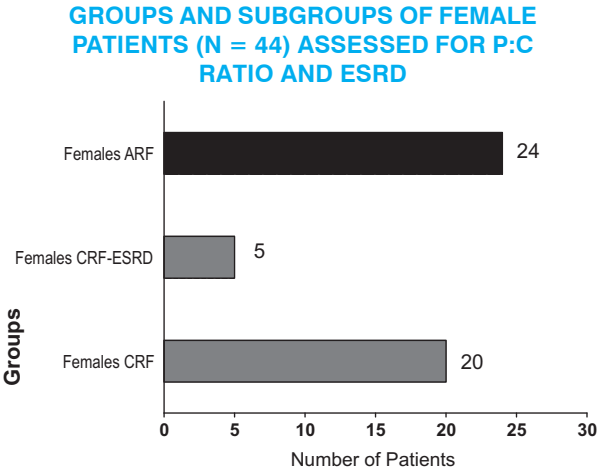

Fig. 3

ratio of ESRD patients when compared with males CRF and ARF groups. Similarly, female groups also showed non-significant difference, whereas ESRD patients (FC_{ES}), depicts moderate (P < 0.05) significance when compared with female CRF and ARF groups. Furthermore, P:C ratio of Males and Females ESRD groups showed non significance difference even at P < 0.05.

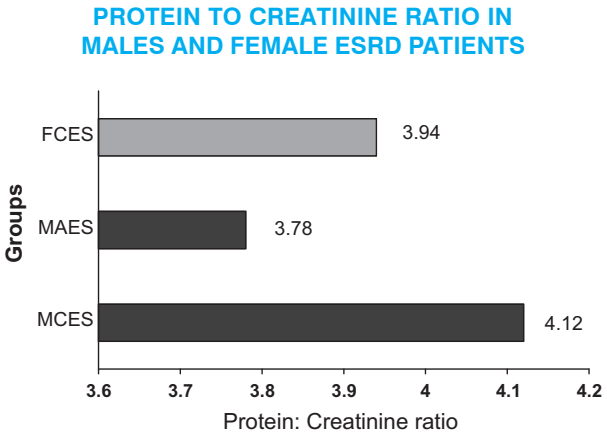

Fig. 4

Mean P:C ratio in MC_{ES} category was 4.12 ± 0.82 (range 2.5 – 9.1) where as in MA_{ES} 3.78 ± 1.67 (range 1.80-7.12) (Fig 4). Mean P:C ratio in FC_{ES} category was 3.94 ± 0.79 (range 1.76 – 5.98).

DISCUSSION

It is known that ESRD and the resulting or proceeding uremic syndrome may be caused by a variety of factors such as chronic glomerulonephritis, chronic pyelonephritis, immunological diseases, hypertension, and toxic and ischemic damage to kidneys. In present study it was found that a total of 16 male patients (12 CRF, 4 ARF) were in the category of ESRD. In female group only 5 patients were categorized as ESRD (all CRF patients). Moreover, maximum P:C ratio in male group was 9.1 and 7.12 for CRF and ARF, respectively, whereas it was 5.98 in female group suggesting a 16% less severity of P:C ratio in females than males.

A study carried out in Indigenous Australians depicts an ESRD incidence of 17.4 times than for non-Aboriginals during 1988-1993. The number of dialysis treatment was also doubling every year[13]. The results showed diabetes, glomerulonephritis and hypertension as the prominent cause of ESRD. Diabetes and nephropathy patients have higher risk of ESRD or doubling of serum creatinine levels[12]. It is also a well known fact that elevated blood pressure, particularly systolic BP, markedly increases both urinary protein excretion and risk of ESRD in patients with diabetes and nephropathy[12,14]. Therefore determination of protein in urine or more specifically protein to creatinine ratio is thus a corner stone in diagnosis, treatment and prognosis of renal diseases[15]. Control of blood pressure and treatment of the original disease, whenever feasible, are the broad principles of management. Until renal transplant therapy, that can maintain patient survival and prolong life, the quality of life is severely affected[16,17]. Renal transplantation increases the survival of patients with ESRD significantly as compared to other therapeutic options[15,18,19]. It is also recommended that high intensity home-hemodialysis appears to be associated with improved survival time [20]. The prognosis of patients with chronic level of disease has shown that all causes of mortality increases as the level of function decreases. In such clinical scenario, estimation of P: C ratio provides a useful, simple and convenient method for quantitative assessment of proteinuria and thus feasible as a tool for evaluation of effectiveness or otherwise failure of management of ESRD.

It is therefore concluded that in present study, patients with > 1.0 of P: C ratio has developed ESRD (n = 21, [117.35%] with respect to total patients n = 121). Moreover, it was also suggested that higher the ratio of P:C, the more was risk of deterioration of clinical condition and non-responsiveness to dialysis subsequently leading to ESRD.

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CONFLICT OF INTEREST

The authors declare no conflict of interest