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Short Article

Effect of Uremia on White Blood Cell Count in Patients with Renal Failure

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A B S T R A C T

Background and Aims: It is believed that uremia causes destruction of white blood cells (WBC) leading to leukopenia. This study attempted to assess the exact effect of uremia on WBC count.

Materials and Methods: This case-control study was conducted on 120 uremic patients and 100 non-uremic control subjects. All cases were examined for determination of urea and creatinine in their serum; complete blood counts were also determined.

Results and Conclusion: In healthy male individuals, the mean values of serum urea and creatinine were 14.5±1.9 and 0.9±0.2 mg/dL, respectively. In females the serum urea concentration was the same as males, but mean serum creatinine was 0.66±3.2 mg/dL. In the patients group, the mean concentration of serum urea for both sexes was 83±2.4 mg/dL. The mean values of creatinine in male and female patients were 2.4±1.3 mg/dL and 2.1±1.7 mg/dL, respectively. The mean total leukocyte counts in case and control groups were 6.08± 2.24 and 6.17± 2.43 $\times 10^9$/L, respectively (p=0.71). Our results indicate that uremia cannot change leukocyte count.

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Introduction

The term uremia is used to describe the illness that is associated with kidney failure. It is known that uremia is due to accumulation of organic waste products which are normally cleared by kidneys. One of the most common components of urine is urea which is normally excreted in urine. Uremia is a complication of chronic kidney disease and acute kidney injury (known as acute renal failure) due to renal failure in excretion of urea and creatinine. It is apparent that kidney failure can lead to health problems [1]. In addition, uremia is associated with some hematologic abnormalities such as anemia, hemostatic disorder, granulocytic disorders, and lymphocytic as well as platelet dysfunction. Excessive bleeding, hemostatic impairment and abnormal platelet test results are common features of uremia [2]. Infections are commonly seen in end-stage renal disease patients. It is said that the incidence of infections increases with elevated serum level of urea, including in patients receiving azathioprine or cyclophosphamide. Also, it is reported that immunosuppression is seen in uremic patients. Additionally, impaired defense systems and resultant infections are seen in patients with renal failure on dialysis. Previous studies have shown that Gram negative septicemia and fungal infections are major causes of morbidity and mortality in patients with acute renal failure [3]. It is known that leukocytes play a major role in host defense response against life-threatening infections [4].

Leukocytes show impaired activity in patients with renal failure. Polymorphonuclear leukocytes (PMNLs) in patients with uremia fail to migrate properly and show defective phagocytosis [5]. It may be the cause of increased susceptibility to infections in uremic patients [6]. It is of great importance to clarify the cause of higher occurrence of infections in uremic patients. In order to shed some light into the mechanism(s) of leukopenia in uremic patients, in the present study we focused on the white blood cell counts and tried to determine the effect of uremia and its related toxins on white blood cell counts.

Materials and Methods

This case-control study was conducted on 120 uremic patients and 100 individuals as the control healthy group. A written consent form was singed by each patient and healthy individual. The nnclusion criterion for patients was documented increased plasma urea and creatinine levels. Initially, all individuals were examined for serum urea and creatinine levels determined by the use of Hitachi automated chemistry analyzer (Hitachi, Japan). Subsequently, complete blood count (CBC) was determined by the use of Sysmex KX21N (Sysmex Corporation, Kobe, Japan) automated hematology analyzer in 2 mL of whole blood admixed with K_2 EDTA. The CBC was performed on each individual instantly, and tests for creatinine and urea were carried out before 2 hours after sampling.

Statistical Analysis

Statistical analysis was performed by SPSS version 11. The results were compared with each other using student t-test.

Results and Discussion

There were 76 (63%) men and 44 (37%) women in the case group, and 62 (62%) men and 38 (38%) women in the healthy group. The age average of men and women participants was 48±2.4 and 44±3.1 years, respectively. In healthy individuals, the mean value of urea in males and females was 14.5± 1.9 mg/dL, respectively, and the mean value of creatinine was 0.9±0.2 mg/dL in males and 0.66±3.2 mg/dL in females. In the patients group, the mean values of creatinine in males and females were 2.4±1.3 mg/dL and 2.1±1.7 mg/dL, respectively. The mean value of urea was 83±2.4 mg/dL in the patients group. The mean of WBC count in case and control groups were 6.08±2.24 and 6.17± 2.43×10^9/L, respectively. As is shown in Table 1, the comparison between the patients and control groups revealed that there is no significant difference between the WBC counts of these two groups (p=0.71).

Table 1. WBC count and serum urea level in patients with uremia vs. healthy controls.

	Groups	Number	Mean ± SD	P Value
Urea (mg/dL)	Control	100	14.5 ± 1.9	0.009
	Case	120	83 ± 2.4	
White blood cells (× 10^9/L)	Control	100	6.17 ± 2.43	0.71
	Case	120	6.08 ± 2.24	

Uremia is one of the complications of kidney disorders which results from accumulation of waste products in patients' plasma. Uremic patients face increased levels of hemoglobin, red cell distribution width and mean cell volume [7]. Uremia associated with immune dysfunction has been described in some studies [4]. Moreover, some immune system functional abnormalities are reported due to accumulation of uremic toxins. Among the immune system dysfunctions are oxidative burst disorders, chemotaxis and phagocytosis abnormalities [4]. In addition, there are some problems with antigen presenting processes in uremic patients [4]. Most of the studies focus on the functional abnormalities of WBC. In the present study, we decided determine the correlation between white blood cell count and increased level of urea in uremic patients. In addition, it is important to investigate if the urea influences the white blood cell counts in cell counter (in vitro conditions). Minnaqanti et al. have expressed that patients with kidney disorders have impaired host defenses [8]. Baqdasarian et al. have shown that patients with renal disease on dialysis are faced with infections as the major cause of mortality and morbidity [3]. These studies reveal that there is an association between kidney disorder and infection. Agrawal et al. have reported that antigen presenting dendritic cells diminish in uremia [9]. Reduced number of B lymphocytes

and their capacity for producing antibody has been reported in uremic patients by Pahl et al. [10]. Depletion of naive and memory T cells in uremic conditions has also been reported by Moser et al. [11].

Conclusion

Our findings indicate that uremia is not associated with decreased white blood cell count. More investigations should be done to clarify the relation between WBC and uremia.

Conflict of Interest

The authors declare that they have no conflicts of interest.

Acknowledgement

There is no acknowledgment to declare.

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