Original Article

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Investigation of the Effect of Gender on Blood Parameters in Acute Renal Failure in Patients Presenting to the Emergency Department of a Hospital

Bilgehan Demir[1], Turgut Dolanbay[1], Suleyman Nogay[1], Fatih Tan[2], Omer Faruk Ongenli[1]

1 Malatya Turgut Özal University School of Medicine, Department of Emergency Medicine, Malatya, Turkey
2 Osmaniye Korkut Ata University, Vocational School of Health Services, Health Care Services Department, Osmaniye, Türkiye

Abstract

Objective: Acute renal failure (ARF) is a sudden change in renal function that prevents the excretion of nitrogenous wastes and disrupts the body's fluid and electrolyte balance. Identification of ARF risk factors and development of indicators that predict mortality are crucial to improve the success of medical care. We aim to evaluate the effect of age and gender factors in patients with ARF and to evaluate the course and frequency of the disease in female patients compared to male patients.

Material and Methods: The data of adult patients over 18 years of age who were hospitalized with a diagnosis of ARF between 01.02.2025-01.03.2025 in the emergency department of Malatya Training and Research Hospital were retrospectively analyzed. Blood laboratory parameters were recorded and analyzed to determine whether these data were positively or negatively associated with gender.

Results: A statistically significant difference was found between age and gender in patients with ARF (p= 0.004). Female patients with ARF were older than male patients. There was a statistically significant relationship between creatinine level and gender in patients with ARF (p=0,017). Creatinine levels were higher in male ARF patients. There was no statistically significant difference between plt, hb, htc, ALT and HALP score and gender (p values 0.384; 0.078; 0.221;0.221; 0.189; 0.174, respectively).

Conclusions: The finding in our study that ARF occurs at older ages compared to men may be explained by the interaction of biological, hormonal, clinical and sociocultural factors. The renal protective effects of estrogen are realized through protection of vascular structure, support of glomerular iltration rate (GFR) and reduction of oxidative stress. However, the decrease in estrogen levels in the postmenopasusal period may be an important factor in the more rapid deterioration of renal function. The pro-inflammatory properties of testosterone and increased oxidative stress, as well as the earlier development of hypertension, atherosclerosis and chronic kidney disease in men, may be another reason why ARF occurs at a younger age in men compared to women.We found that creatinine levels were significantly higher in male patients with ARF compared to female patients. Men are known to have more muscle mass in general compared to women and this may lead to higher creatinine levels in men.

Keywords: Akut Renal Failure, Oxsidative Stress, Testosterone, Estrogene

Introduction

Acute renal failure (ARF) is generally defined as a sudden change in renal function that prevents the excretion of nitrogenous wastes (urea) from the body and disrupts the body's fluid and electrolyte balance. ARF is the sudden loss of renal function resulting in failure of urinary excretion and consequent increase in blood urea nitrogen (BUN: Blood urea nitrogen) and serum creatinine. (1) These definitions used for the diagnosis of ARF are qualitative and a quantitative definition has not yet been found and is still a matter of debate.(2-4) One of the difficulties in making the diagnosis of ARF is that increased serum creatinine or blood urea nitrogen levels do not provide information about whether renal failure is chronic or acute. (1,3). This situation is effective in determining patient treatment, follow-up and hospitalization. There are studies in the literature indicating that the detected laboratory values affect the clinical course. We think that gender

Corresponding author: Bilgehan Demir
e-mail: bilgehan.demir@ozal.edu.tr
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ORCID:
Bilgehan Demir: orcid.org/ 0000-0003-3458-2398
Turgut Dolanbay: orcid.org/ 0000-0002-4092-1192
Suleyman Nogay: orcid.org/ 0000-0003-1184-9467
Fatih Tan: orcid.org/ 0000-0003-2995-4628
Omer Faruk Ongenli: orcid.org/ 0009-0009-8947-0458
Eltaf Torun: orcid.org/ 0000-0003-1251-2065

may also affect this clinic. No study has been found showing the relationship between ARF patients and gender. In our study, we aimed to examine the effects of both laboratory parameters and gender alone or together on clinical progression.

Material Method

Our study was initiated after obtaining the ethics committee approval numbered 2025/74 dated 12.05.2025 from the non-interventional ethics committee of Malatya Turgut Ozal University Faculty of Medicine. The data of adult patients over 18 years of age who were admitted to the emergency department of Malatya Training and Research Hospital between 01.02.2025-01.03.2025 with a diagnosis of acute renal failure (ARF) were retrospectively analyzed. blood parameters [hemogram: leukocytes (10³¼uL) (WBC), hemoglobin (g/dL) (hgb), hematocrit (%) (htc), platelets (103/uL) (plt), mean erythrocyte volume (fL) (MCV), neutrophils (10³¼L), lymphocytes (10³¼uL), monocytes (10³¼uL), neutrophil percentage (%neu); Biochemistry: C reactive protein (mg/dL) (CRP), urea (mg/dL), creatinine (mg/dL) (creat), aspartate aminotransferase (U/L) (AST), alanine aminotransferase (U/L) (ALT), albumin (g/dL) (alb), glucose (mg/dL) (glc), sodium (mmol/L) (Na), potassium (mmol/L) (K), chlorine (mmol/L) (Cl), calcium (mg/dL) (Ca), blood gas: pH, pO2(mmHg), pCO2(mmHg), lactate, FCOHB(%),

HALP score and its correlation with gender to determine whether it is an important parameter.

Biochemical markers were measured in the biochemistry laboratory of our hospital using About Device, CRP, urea, creatinine, AST, ALT, alb, glc, Na, K, Cl and Ca kits. Hemogram parameters were measured using Cell pack DST, DCL, WNR, WDF and SLS Lysercell kits on SYSMEX XN-1000 h device in the biochemistry laboratory of our hospital. In total, 55 pediatric patient data were accessed and our study was conducted with the data of 44 patients who met the inclusion and exclusion criteria.

Inclusion Criteria

Patients over 18 years of age with a diagnosis of ARF and hospitalization.

Patients admitted to our hospital between 01.02.2025-01.03.2025 and hospitalized with a diagnosis of ARF, whose data were retrospectively accessed from the hospital information system.

Exclusion Criteria

Patients under eighteen years of age.

Patients whose data cannot be fully accessed in the hospital data system.

All patients on anticoagulant and coagulant therapy.

Patients who were referred to different hospitals from the emergency department or who refused hospitalization

Tablo 1. Age, HALP score and laboratory parameters of patients

	n	Mean ±SD	*Median (Min-Max)*
Age (year)	44		77 (29-103)
Hgb (g/dL)	44	11,5±2,5	
Htc (%)	44	35,5±7,9	
Üre (mg/dL)	44	183±71,8	
Alb (g/dL)	44	2,8±0,6	
K (mmol/L)	44	5,5±1,3	
WBC (103/uL)	44		12,1 (3,8-34,3)
Plt(103/uL)	44		246 (98-801)
Lymp (mcL)	44		1,3 (0-6)
Monocytes (mcL)	44		0,7 (0-3,2)
Basophils (103/uL)	44		0,04 (0-0,2)
Eosinophils (mcL)	44		0,06 (0-2,4)
Creatinine(mg/dL)	44		4,3 (1,4-19,5)
AST (U/L)	44		27,5 (7-4001)
ALT (U/L)	44		20 (4-2894)
LDH (U/L)	44		302,5 (127-4395)
Ca (mg/dL)	44		8,6 (5-11,9)
Na(mmol/L)	44		134 (122-166)
Crp (mg/ dL)	44		7,5 (0,1-35)
HALP	44		1,5 (0-10,5)

voluntarily and had a previous diagnosis of ARF were excluded from the study.

Statistical Analysis

IBM SPSS statistics 27 program was used for statistical analyses while evaluating the findings obtained in the study. The conformity of the parameters to normal distribution was evaluated by shapiro wilk test. Descriptive statistical methods were given as mean, median, standard deviation, percentage (25-75% (Inter Quantile Range-IQR) and frequency. When comparing quantitative data, student t test was used for comparisons of normally distributed parameters between two groups and mann whitney u test was used for comparisons of non-normally distributed parameters between two groups. For quantitative data (blood parameters and inflammatory indices), correlation analysis was performed to determine the relationship between creatine and HALP score. Our study was planned retrospectively and all patients who met the inclusion and exclusion criteria were included.

Results

Mean ≤ SD values of the parameters with parametric distribution and median (min-max) values of the parameters with nonparametric distribution were 77 (29-103) years of age, respectively, hgb (g/dL) 11.5+2.5 htc(%) 35.5#7.9, urea (mg/dL) 183+71.8, Alb (g/dL) 2.8+0.6, K (mmol/L) 5.5t1.3, WBC (103/uL) 12.1 (3.8-34.3), Plt (103/uL) 246 (98-801), Lymp (mcL) 1.3 (0-6), Monocyte (mcL) 0.7 (0-3.2), Basophil (103/uL) 0.04 (0-0.2), Eosinophil (mcL) 0.06 (0-2.4), Creatinine (mg/dL) 4.3 (1.4-19.5), AST (U/L) 27.5 (7-4001), ALT (U/L) 20 (4-2894), LDH (U/L) 302.5 (127-4395), Ca (mg/dL) 8.6 (5-11.9), Na (mmol/L)134 (122-166), Crp (mg/dL) 7.5 (0.1-35), HALP 1.5 (0-10.5) and given in Table 1. P values of age and blood parameters in patients with ARF according to gender, respectively Age 0.004, WBC (103/uL) 0.170, PIt (103/uL) 0.384, Creatinine (mg/dL) 0.017, ALT (U/L)0.189, HALP 0.174, Hgb (g/dL) 0.078, Htc (%) 0.221 and p values of age and blood parameters according to gender are given in Table 2. A statistically significant difference was found between age and gender in patients with ARF (p= 0.004). In patients with ARF, women were older than men.

A statistically significant relationship was found between creatinine level and gender in patients with ARF (p=0.017). Creatinine level was higher in male ARF patients.

There was no statistically significant difference between plt, hb, htc, ALT and HALP score and gender (p values 0.384; 0.078; 0.221; 0.189; 0.174, respectively).

Discussion

ARF is recognized as one of the most important causes of mortality and morbidity among patients followed up in hospitals in our country and worldwide. Patients diagnosed with ARF may present to hospitals in the presence of symptoms such as oliguria, edema and oral intake disorder, especially infection, and may rarely be asymptomatic (1-5). Identification of ARF risk factors and development of indicators predicting mortality are crucial to

Tablo 2. The Relations vereen Age, Blood Parameters and Gender in Patients with ARF

	Mortality	*n*	*P value*
Age	K	18	0,004**
	E	26	
WBC (103/uL)	K	18	0,170**
	E	26	
Plt(103/uL)	K	18	0,384**
	E	26	
Creatinine(mg/dL)	K	18	0,017**
	E	26	
ALT (U/L)	K	18	0,189**
	E	26	
HALP	K	18	0,174**
	E	26	
Hgb (g/dL)	K	18	0,078*
	E	26	
Htc (%)	K	18	0,221*
	E	26	

Notes. *student t test, **mann Whitney u

improve the success of medical diagnosis and care from both clinical and administrative perspectives.

As a result of our investigations, we evaluated the effect of age and gender factors in patients with ARF and found that ARF occurs at older ages in female patients compared to male patients. This finding may be explained by the interaction of biological, hormonal, clinical and sociocultural factors.

It would be a more rational approach to evaluate the effect of gender on renal function primarily through hormonal differences. The renal protective effects of estrogen are realized by protecting the vascular structure, supporting glomerular filtration rate (GFR) and reducing oxidative stress (6). In women, estrogen increases renal perfusion by regulating renal hemodynamics and protects renal cells from inflammation-related damage thanks to its anti-inflammatory properties (7). However, the decrease in estrogen levels in the postmenopausal period may be an important factor in more rapid deterioration of renal function (8). This may be considered as an important biological mechanism that may explain the occurrence of ARF at older ages in women in our study. In men, the effects of testosterone on renal functions are different. The proinflammatory properties of testosterone and its contribution to the increase in oxidative stress may lead to deterioration of renal function at an earlier age in patients with male ARF (9). In addition, hypertension, atherosclerosis and chronic kidney disease are known to develop at an earlier age in men, which may suggest another important reason why ARF in men occurs at a younger age than in women (10).

In addition to age and gender, the presence of chronic diseases parallel to that period may also be among the determining factors in the development of ARF. In men, factors that increase susceptibility to ARF such as diabetes mellitus and cardiovascular diseases usually occur at an earlier age (11). On the other hand, the development of these diseases in women occurs at older ages; the increase in hypertension and metabolic syndrome, especially in the postmenopausal period, leads to deterioration in renal function (12). In our study, the occurrence of ARF in women at older ages seems to be consistent with the effect of these clinical factors. In addition, it is known that the progression of ARF differs between genders. In a study in the literature, it was reported that ARF progressed faster in men and the risk of reaching terminal renal failure was higher in men than in women(8). This suggests that in addition to biological and clinical factors, sociocultural factors also play an important role in the development of ARF. The fact that women recognize health problems later or act later in seeking medical help may cause delays in the diagnosis of ARF. This may be one reason why ARF is often diagnosed at an older age in women. However, dietary habits and lifestyle factors can also affect kidney health. factors such as higher salt consumption, smoking and obesity are common in men, which may predispose to the development of hypertension and diabetes and increase the risk of ARF (13-15). Although women generally have healthier eating habits, a rapid decline in renal function may be observed in the postmenopausal period due to metabolic changes (16).

Studies examining the effect of gender on ARF have reported that women can maintain renal function longer than men and that ARF occurs at older ages in women. In a recent study, it was reported that women are more resistant to the development of renal failure and this may be related to hormonal mechanisms (10). However, some studies suggest that gender has no significant effect on ARF (17). These differences may be due to methodologic approaches used in the studies and population differences. The findings of our study are generally consistent with previous studies supporting the effect of gender on the development of ARF.

Another important finding of our study was that creatinine levels were significantly higher in male patients with ARF compared to female patients. This difference may be due to physiologic, hormonal and muscle mass differences between the sexes. Serum creatinine is a by-product of muscle metabolism and is a widely used biomarker to assess renal function (18). It is known that men generally have more muscle mass compared to women, leading to higher creatinine levels in men (19,20). However, the difference in creatinine levels between the sexes is not only due to muscle mass. Previous studies have shown that men lose renal function earlier and have a more rapid decline in GFR compared to women (10). The reasons for this include hormonal factors, hemodynamic changes and cardiovascular risk factors (8,20).

Although serum creatinine levels are a commonly used parameter in the evaluation of renal function, they have some limitations. Creatinine levels reflect not only GFR but also many other factors such as muscle mass, diet, hydration status and metabolic rate (21). Therefore, it should be kept in mind that higher creatinine levels in men may not only indicate loss of renal function but may also be due to excess muscle mass (22). In recent years, biomarkers other than creatinine have been shown to be more reliable in assessing renal function. Especially cystatin C may provide a more accurate assessment of renal function because it is a marker independent of muscle mass. It has been reported that cystatin C shows less variability compared to creatinine and can detect renal dysfunction at an earlier stage (23).

The findings of our study show that male patients have a higher risk of ARF and their renal function deteriorates more rapidly. In this context, it is clinically important to monitor the renal health of male patients more closely and

to implement early screening programs especially in high-risk individuals. Although creatinine levels are a basic biomarker for assessing renal function, failure to consider gender-specific reference values may lead to misinterpretation. Higher creatinine levels in male patients may indicate a faster decline in renal reserve capacity, but may also be a physiologic variability due to muscle mass.

Therefore, the use of gender-specific GFR calculation methods and biomarkers other than creatinine is important for a more sensitive renal function assessment (23).

In conclusion, if we look at our study from a general perspective, it has limitations as well as strengths. Due to its retrospective design, it is not possible to determine the cause-and-effect relationship with certainty. In addition, factors that may affect creatinine levels such as muscle mass, dietary habits and hydration status of the participants were not analyzed in detail. Future prospective studies should more comprehensively examine the impact of gender on renal function and focus on the assessment of biomarkers other than creatinine. The finding that creatinine levels are higher in male patients compared to female patients may be explained by several mechanisms, including greater muscle mass in men, earlier deterioration of renal function and hormonal factors. In clinical practice, it is important to consider gender-specific reference values and to evaluate biomarkers other than creatinine for a more accurate disease management. Similarly, another important finding in our study, that ARF occurs at older ages in women compared to men, may be explained by the interaction of hormonal changes, comorbidities and sociocultural factors. We believe that these findings will enable and guide the identification of gender-specific risk factors and the development of new strategies for the prevention of ARF.

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