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MEDICAL SCIENCES / DAHİLİ TIP BİLİMLERİ

Does Age Have an Effect on Outcome in Critically Ill Patients with Acute Kidney Injury?

Akut Böbrek Hasarı Olan Kritik Hastalarda Yaşın Sonlanıma Etkisi Var mı?

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Abstract

Objectives: Acute kidney injury (AKI) is a clinical condition that is frequently encountered during admission to an intensive care unit (ICU). The aim was to answer the question of whether critically ill elderly patients with AKI who were admitted to ICU had a higher mortality than younger patients with AKI.

Materials and Methods: All patients admitted to ICU were screened for the presence of AKI for one year. These patients were divided into two groups depending on their age: Patients <80 years old and patients ≥80 years old. Groups were compared in terms of their characteristics, need for renal replacement therapy (RRT), mortality, and the factors that might affect these outcomes.

Results: A total of 305 patients were screened: 92 (30%) patients had AKI and were eligible for the study. Of these, 44 (48%) were <80 years and 48 (52%) were ≥80 years. The two groups were similar when disease severity and expected mortality rates were compared using APACHE II scores. Of patients <80 years, 19 (43%) underwent RRT and this was higher than observed in the elderly (p=0.001). However, there was no difference between the groups in terms of ICU mortality (p=0.63).

Conclusion: ICU mortality may not be as high as expected in the presence of acute renal injury in elderly critically ill patients.

Key Words: Elderly, Critically Ill, AKI, RRT

Öz

Amaç: Akut böbrek hasarı (ABH), yoğun bakım ünitesine (YBÜ) kabul sırasında sıklıkla karşılaşılan klinik bir durumdur. Amaç, YBÜ'ye kabul edilen kritik hastalığı olan yaşlı ABH hastalarının, ABH olan genç hastalara göre daha yüksek mortaliteye sahip olup olmadığı sorusuna cevap vermekti.

Gereç ve Yöntem: YBÜ'ye kabul edilen tüm hastalar bir yıl boyunca ABH varlığı açısından tarandı. Bu hastalar yaşlarına göre ikiye ayrıldı: Seksen yaş altı hastalar ve 80 yaş üstü hastalar. Gruplar renal replasman tedavisi (RRT) ihtiyacı, mortalite ve bu sonuçları etkileyebilecek faktörler açısından karşılaştırıldı.

Bulgular: Toplam 305 hasta tarandı: 92 (%30) hastada ABH vardı ve çalışma için uygun bulundu. Bunlardan 44'ü (%48) <80 yaş ve 48'i (%52) ≥80 yaş idi. APACHE II skorları kullanılarak hastalık şiddeti ve beklenen ölüm oranları karşılaştırıldığında iki grup benzerdi. Seksen yaşın altındaki hastaların 19'una (%43) RRT uygulandı ve bu yaşlılarda gözlenenden daha yüksekti (p=0,001). Ancak YBÜ mortalitesi açısından gruplar arasında fark yoktu (p=0,63).

Sonuç: Yaşlı kritik hastalarda ABH hasarı varlığında YBÜ mortalitesi beklendiği kadar yüksek olmayabilir.

Anahtar Kelimeler: İleri Yaş, Kritik Hasta, ABH, RRT

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Introduction

The number of elderly people is increasing day by day around the world. This increase is similarly reflected in hospital admissions. The majority of patients admitted to intensive care units (ICU) are elderly patients (1-3).

Acute kidney injury (AKI) is a common condition during admission to or stay in an ICU (1,2). With the increasing age, structural and functional changes are observed in the kidneys (4). Aging kidney becomes more sensitive to nephrotoxic conditions as a result of these changes (4,5). The effects of critical illness and age significantly increase the possibility of AKI in elderly patients. Unfortunately AKI is known to increase ICU morbidity and mortality (1). There are studies suggesting that the probability of mortality and morbidity is higher with AKI in elderly (2,4-6).

The aim of this study was to evaluate the mortality rate and need for renal replacement therapy in elderly critically ill patients (≥80 years) who were admitted to ICU with AKI.

Materials and Methods

The records of patients admitted to a public hospital's tertiary ICU between June 2017 and July 2018 were retrospectively reviewed for patients with AKI. Patients under the age of 18, patients with less than 24 hours of stay in ICU, patients with renal transplantation, dialysis patients with chronic renal failure, and postoperative admissions were excluded. Patients were examined for the presence of acute kidney damage according to KDIGO 2012 criteria, taking into account 0.3 mg/dL rise in the last 48 hours or an increase in creatinine values 1.5 fold in the last 7 days (7). Patients admitted to the ICU those with AKI according to KDIGO 2012 criteria were included in the study.

Renal replacement therapy was administered to patients after adequate fluid replacement was completed as clinically guided by physical examination and laboratory tests; except for emergency indications such as severe hyperkalaemia, severe metabolic acidosis, pulmonary edema, uremic complications.

Age, sex, comorbidities, admission diagnosis, APACHE II scores, length of ICU stay, mechanical ventilation support and vasopressor requirement, renal replacement therapy requirement and ICU mortality were recorded. Also patients' urea, creatinine levels and type of AKI (prerenal, renal, postrenal) were recorded.

In our study, the cut-off for advanced age was determined as 80. The patients were grouped according to their age. Patients under 80 years of age were included in group 1 and patients 80 years and older were included in group 2. Both groups were evaluated in terms of mortality and need for renal replacement therapy in ICU and the factors that may have an effect on these results. Ethics committee approval was received for this study from the local ethics committee (no: 18-1216-18).

Statistical Analysis

Data were analysed using IBM SPSS 25 program. Numerical data were tested for normal distribution. As descriptive statistics, the mean ± standard deviation or median interquartile range (IQR), based on assumptions for numerical variables, and the categorical variable frequency (n) and percentage (%) are given. Pearson's chi-square test was used to analyze categorical variables. The Mann-Whitney U test was used to examine the significance of differences between the two groups in terms of numerical variables. Parametric data were expressed as mean ± standard deviation and independent samples Student's t-test was used for comparison. In all analyses, the probability of a type I error was taken as 0.05.

Results

Of the 305 patients admitted to the ICU during a 1-year period, 92 patients with AKI who met the inclusion criteria were included in the study, the remaining 213 patient excluded from the study. The patients' demographic and clinical characteristics are presented in Table 1. There were 44 (48%) patients in group 1 and 48 (52%) patients in group 2. The mean age of the patients was 77±11, and the mean age of the group 1 was 68.5±10 and group 2 was 86±4, respectively. Our study population was older than 65 years accept 9 patients. The number of male patients in group 1 was 28 (63.6%) and in group 2 was 17 (35.4%). It was significantly higher in group 1 than group 2 (p=0.007).

The mean APACHE II value was found to be 23.5±6.91. APACHE II scores were not different between groups (p=0.59).

Forty-two (45%) patients received vasopressors. There was no difference in the rates of vasopressor requirement between two groups (p=0.64). The total number of patients undergoing mechanical ventilation support was 58 (63%). There was no difference between the groups in terms of mechanical ventilation support.

Forty (43.5%) of the patients died in the ICU. When the groups were compared in terms of ICU mortality, no difference was found (p=0.63).

The length of ICU stay changed between 1 and 92 days and the median was 8 (IQR 14.5). There was no difference between the two groups in terms of length of ICU stay (p=0.78).

A total of 25 (27%) patients underwent renal replacement therapy. In group 1, 19 patients and in group 2, 6 patients underwent renal replacement therapy and this rate was significantly higher in group 1 (p=0.001).

The median urea values of the patients were 126.4 mg/dL and there was no difference between the groups (p=0.46). The

median creatinine values were 2.1 mg/dL and the difference between the groups was not significant (p=0.07). There was a trend towards different aetiologies. Renal type AKI was more common in Group 1 and prerenal type AKI was more frequent in Group 2. However, the difference was not found to be statistically significant (p=0.06).

The admission diagnosis and comorbidities of patients are also presented in Table 1. Dementia was more frequent in the elderly patients (p=0.04).

The length of ICU stay was longer in non-survivors (p<0.001) (Table 2). Need for renal replacement therapy, vasopressor therapy and mechanical ventilation was higher in non-survivors. Prerenal type AKI was observed more often in the survivor group (p=0.005).

Discussion

According to the data obtained by screening retrospectively the patients admitted to the ICU for one year, AKI rate at admission to the ICU was 30%. Contrary to expectations, there was no difference in the ICU mortality rates between the two groups. Disease severity and mortality rates evaluated by APACHE II score were similar between groups. However, younger patients more frequently needed renal replacement therapy.

AKI is an increasingly common clinical condition during admissions to the hospital. It is seen in 20% to 50% of patients admitted to the ICU (4,8). Bagshaw et al. (6) also demonstrated that AKI rates increased in patients admitted to the ICU. As a result, length of ICU stay may be longer and mortality may be higher in these patient groups. Especially in advanced age critically ill patients, AKI may be a serious problem due to changes in the kidney due to aging, difficulties in regulating the hemodynamic response and numerous comorbid diseases.

In the study conducted by Yokota et al. (9), it was reported that the mortality rate was increased in elderly patients admitted to the ICU with AKI. However, the advanced age was defined as ≥60 years old in Yokota et al.'s (9) study. In another study by Liu et al. (10), the advanced age was similarly defined

Table 1: Patients' demographics and clinical characteristics

	Group 1 (n=44)	Group 2 (n=48)	Total (n=92)	p
Age, years, mean ± SD	68.5±10	86±4	77±11	
Male, n (%)	28 (63.6%)	17 (35.4%)	45 (48.9%)	0.007
APACHE II, mean ± SD	24.75±7.11	23.97±6.78	23.5±6.91	0.59
Comorbidities, n (%)				
Cardiac failure	17 (38%)	18 (37%)	35 (38%)	0.91
Hypertension	11 (25%)	16 (33%)	27 (29%)	0.38
Diabetes mellitus	11 (25%)	13 (27%)	24 (26%)	0.82
Neurologic disorder	11 (25%)	9 (18%)	20 (21%)	0.46
Dementia	4 (9%)	12 (25%)	16 (17%)	0.04
Admission diagnosis, n (%)				0.21
Respiratory failure	21 (47.7%)	19 (39.6%)	40 (43.5%)	
Sepsis	8 (18.2%)	9 (18.9%)	17 (18.5%)	
Heart failure	7 (15.9%)	8 (16.7%)	15 (16.3%)	
Gastrointestinal hemoraghe	3 (6.8%)	4 (8.3%)	7 (7.6%)	
Other	5 (11.4%)	7 (14.6%)	12(14.1%)	
Vasopressor therapy, n (%)	19 (43.2%)	23 (47.9%)	42 (45%)	0.64
Mechanical ventialtion, n (%)	29 (65.9%)	29 (60.4%)	58 (63%)	0.55
Urea, mg/dL (median, IQR)	128.7 (82.4)	124.9 (79.4)	126.4 (76.3)	0.46
Creatinine, mg/dL (median, IQR)	2.4 (1.9)	1.6 (1.5)	2.1 (1.8)	0.07
Length of ICU stay, (median, IQR)	8 (12.7)	8 (17)	8 (14.5)	0.78
Renal replacement therapy, n (%)	19 (43%)	6 (12.5%)	25 (27%)	0.001
AKI type, n (%) Prerenal AKI Renal AKI Postrenal AKI	 16 (36%) 28 (64%) 0	 27 (56%) 21 (44%) 0	 43 (47%) 49 (53%) 0	0.06
Mortality, n (%)	18 (41%)	22 (46%)	40 (43%)	0.63

SD: Standard deviation, ICU: Intensive care unit, IQR: Interquartile range, AKI: Acute kidney injury

Table 2: Characteristics of survivors and non-survivors

	Survivors (n=52)	Non-survivors (n=40)	Total (n=92)	p
Age (median, min-max)	79.5 (39-101)	80 (38-97)	80 (38-101)	0.91
Male (%)	29 (31.5%)	16 (40%)	45 (48.9%)	0.13
APACHE II, mean ± SD	22.34±6.16	26.95±7.04	23.5±6.91	0.01
Urea (median, IQR)	124.95 (75.3)	133.4 (81.1)	126.4 (76.3)	0.93
Creatinine (median, IQR)	2.53 (1.90)	1.48 (1.23)	2.1 (1.8)	0.02
Length of stay ICU (median, min-max)	5 (1-54)	11.5 (1-92)	8 (1-92)	<0.001
Renal replacement therapy (%)	9 (17%)	16 (40%)	25 (27%)	0.01
Vasopressor therapy, n (%)	11 (21%)	31 (77.5%)	42 (45%)	<0.001
Mechanical ventilation (%)	20 (38%)	38 (95%)	58 (63%)	<0.001
AKI type Prerenal AKI Renal AKI Postrenal AKI	 31 (60%) 21 (40%) 0	 12 (30%) 28 (70%) 0	 43 (47%) 49 (53%) 0	0.005

SD: Standard deviation, min: Minimum, max: Maximum, ICU: Intensive care unit, IQR: Interquartile range, AKI: Acute kidney injury

as ≥60 years old. They examined patients with acute kidney damage during hospital admission and follow-up; and they reported higher mortality in older patients. However, in contrast to these findings, in our study, mortality rate was similar in both age groups. There may be many reasons for the finding that elderly patients with AKI have similar mortality rates compared to younger ICU patients. One reason may be the fact that, the younger group in our study had an average age of 68.5 years which is in fact in the geriatric range as well.

Funk et al. (11) examined patients who presented to the nephrology department and took the age cut-off as 80 years. Similar to our study, there was no difference in mortality between the groups. Further in this study the requirement for renal replacement therapy was higher in the younger patient group. However, although the patients who applied to a 3rd stage nephrology department may show similar results with the patients followed up in the ICU, it is clear that they are in different clinical states than our patients.

Kane-Gill et al. (12) reported higher rate of the need for renal replacement therapy in critically ill patients with acute renal injury under 75 years of age. Similarly, in this study, the requirement for renal replacement therapy was observed more frequently in the younger group. This and our finding may also be attributed to the more frequent observation of renal type AKI in younger patients. Another reason may be the fact that; patients were included in the study with AKI on ICU admission, and those developing AKI during follow-up in the ICU were not included.

Novo-Veleiro et al. (13) reported higher mortality in patients older than 75 years with AKI and non-valvular atrial fibrillation. This study was conducted with patients who were followed in the internal medicine ward. Patients also had non-valvular atrial fibrillation, which is known to increase mortality in many patients.

Dementia rate was found to be high in our elderly group, as expected. Immobilization and caregiver dependence are higher in these patients. Therefore, dehydration may have been more common in these patients. These patients are more prone to acute kidney damage after dehydration. Decreased renal mass and decreased renal blood flow with advanced age also predispose to prerenal AKI in these patients. In our study, it was seen that prerenal AKI was more common in elderly patients. When survivors and non-survivors were compared; patients with prerenal AKI were more likely to survive. This is thought to be one of the reasons why there was no difference between the mortality rates of older patients and younger patients.

A study published by Akposso et al. (14) about 20 years ago, yielded similar findings. In this study, patients admitted to the ICU with acute renal failure over 80 years of age were examined. Mortality rates were found to be similar compared to the general population, especially in elderly patients with prerenal AKI (14).

The male gender was found higher in Group 1. Likewise in Güzel et al. (15) study, they stated that AKI was more common in male patients. They found that AKI was more prevalent in males under 65 years of age than their female counterparts (15). In older group less significant difference could be explained by the effects of aging on kidney (4).

Creatinine levels were lower in elderly patients. Although not evaluated in terms of sarcopenia, it is commonly observed that these patients have less muscle mass.

Study Limitations

There are limitations in our study. Firstly, it is a single-center retrospective study. Patients were examined for AKI during their

admission to the ICU based on their creatinine levels, since urine output was not available for all patients. Secondly, patients were included in the study with AKI on ICU admission, and those developing AKI during follow-up in the ICU were not included. Another important point worth discussion is the cut-off age chosen to define advanced age. There are different cut-off values across studies. In this study, the age cut-off was defined as 80 years to include the very elderly patients. So, the fact that the average age of the patients grouped as younger was above 65 which could have also been another limitation of the study. Power analysis could not be calculated due to the retrospective nature of the study.

Conclusion

ICU mortality may not be as high as speculated in the presence of AKI in elderly critically ill patients. It is important to bear in mind that, elderly critically ill patients with AKI will respond appropriately to an early diagnosis and appropriate treatment, similar to all other critically ill patients.

Main Points

- The effects of critical illness and age significantly increase the possibility of AKI in elderly patients. Unfortunately AKI is known to increase ICU morbidity and mortality.

- Patients admitted to ICU with AKI were grouped to their age that were over 80 or not. When the groups were compared in terms of ICU mortality, no difference was found.

- It is important to bear in mind that, elderly critically ill patients with AKI will respond appropriately to an early diagnosis and appropriate treatment.

Ethics

Ethics Committee Approval: The study was approved by the local ethics committee. IRB approval number is 18-1216-18.

Informed Consent: Informed consent was not required because this study was retrospective and the data analysed anonymously.

Peer-reviewed: Externally peer-reviewed.

Authorship Contributions

Concept: L.T., N.D.A., Design: L.T., N.D.A., Data Collection or Processing: L.T., N.D.A., Analysis or Interpretation: L.T., N.D.A., Literature Search: L.T., N.D.A., Writing: L.T., N.D.A.

Conflict of Interest: The authors declare that there is no conflict of interest.

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