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Impact of Contrast-Enhanced Imaging on Renal Function: Evaluation of Patients Hospitalized with Acute Kidney Injury from the Emergency Department with a History of Contrast Enhanced Imaging Within the Last Year

Kontrastlı Görüntülemenin Böbrek Fonksiyonlarına Etkisi: Son Bir Yıl İçerisinde Kontrastlı Görüntüleme Öyküsü Olan ve Acil Servisten Akut Böbrek Yetmezliği Tanısı ile Yatırılan Hastaların Değerlendirilmesi

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Abstract

Aim: The aim of this study was to evaluate the effects of contrast-enhanced imaging performed within the previous year on renal function in patients hospitalized with a diagnosis of acute kidney injury from the emergency department

Material and Method: This retrospective study was conducted in the emergency department of a public hospital. Medical records of 153 patients admitted between January 1, 2024, and December 31, 2024, with a diagnosis of acute kidney injury were reviewed. Patients were divided into two groups: those who underwent contrast-enhanced imaging (n=44) and those who did not (n=109). Demographic data, comorbidities, medications, laboratory parameters, hemodialysis requirements, and mortality rates were recorded. Categorical variables were analyzed using the Chi-square test, and continuous variables were assessed using Student's t-test or Mann–Whitney U test. A p-value of <0.05 was considered statistically significant at a 95% confidence interval.

Results: The mean age of the patients was 72.66±14.42 years, and 58.8% were male. The rate of hemodialysis was significantly higher in the contrast-enhanced imaging group (43.8%) compared with the non-contrast group (19.1%; p=0.001). Similarly, the mortality rate was 47.6% in the contrast group and 22.5% in the non-contrast group (p=0.005). However, no significant differences were observed between the two groups in terms of estimated glomerüler filtration rate (p=0.742), creatinine (p=0.239), urea (p=0.471), potassium (p=0.140), pH (p=0.129), or HCO_3 (p=0.491). Lactate levels were significantly higher in the contrast-enhanced group (p=0.036).

Conclusion: Although higher mortality and dialysis rates were observed in patients with a history of contrast-enhanced imaging, no significant differences were found in baseline renal function parameters. These findings suggest an association rather than a causal relationship between contrast exposure and adverse clinical outcomes, indicating that comorbid disease burden and overall clinical status may be more influential determinants.

Keywords: Contrast media, acute kidney injury, contrast-associated nephropathy, hemodialysis, mortality

Öz

Amaç: Bu çalışmanın amacı, acil servisten akut böbrek yetmezliği tanısı ile yatırılan hastalarda son bir yıl içerisinde yapılan kontrastlı görüntüleme uygulamasının böbrek fonksiyonları üzerindeki etkilerini değerlendirmektir.

Gereç ve Yöntem: Bu çalışma retrospektif olarak bir devlet hastanesi acil servisinde yapıldı. Çalışmada 01.01.2024-31.12.2024 tarihleri arasında acil servisten akut böbrek yetmezliği tanısı ile hastaneye yatırılan toplam 153 hastanın dosya kayıtları geriye dönük olarak incelendi. Hastalar kontrastlı görüntüleme yapılan (n=44) ve yapılmayan (n=109) olmak üzere iki gruba ayrıldı. Demografik veriler, ek hastalıklar, kullanılan ilaçlar, laboratuar bulguları, hemodiyaliz gereksinimi ve mortalite oranları kaydedildi. Kategorik değişkenler için Ki-kare testi ve sürekli değişkenler için Sudent T testi veya Mann-Whitnay U testi kullanıldı. Yüzde 95 güven aralığında p<0,05 anlamlı kabul edildi.

Bulgular: Hastaların yaş ortalaması 72,66±14,42 yıl olup %58,8'i erkekti. Kontrastlı görüntüleme yapılan grupta hemodiyaliz oranı (%43,8) kontrastsız gruba göre anlamlı olarak daha yüksekti (%19,1; p=0,001). Benzer şekilde mortalite oranı kontrastlı grupta %47,6 iken kontrastsız grupta %22,5 olarak bulundu (p=0,005). Ancak tahmini glomerüler filtrasyon hızı (p=0,742), kreatinin (p=0,239), üre (p=0,471), potasyum (p=0,140), pH (p=0,129) ve HCO_3 (p=0,491) değerleri açısından iki grup arasında anlamlı fark saptanmadı. Laktat düzeyi kontrast uygulanan grupta anlamlı derecede yüksekti (p=0,036).

Sonuç: Kontrastlı görüntüleme öyküsü bulunan hastalarda mortalite ve diyaliz gereksinimi oranları daha yüksek saptanmasına karşın, temel renal fonksiyon parametreleri açısından anlamlı bir fark izlenmemiştir. Bulgular, kontrast maruziyeti ile olumsuz klinik sonlanımlar arasında bir ilişki olduğunu düşündürmekte olup, nedensel bir etkiyi göstermemektedir; eşlik eden hastalık yükü ve genel klinik durumun daha belirleyici olabileceğine işaret etmektedir.

Anahtar Kelimeler: Kontrast madde, akut böbrek yetmezliği, kontrast ilişkili nefropati, hemodiyaliz, mortalite

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INTRODUCTION

Emergency departments (EDs) are high-volume care settings that encounter a wide spectrum of diseases. Accurate diagnosis relies heavily on patient history, physical examination, and imaging modalities.[1] Imaging techniques utilizing contrast media, such as computed tomography (CT), magnetic resonance imaging (MRI), and coronary angiography (CAG), play a crucial role in diagnosis and clinical decision-making, particularly in critically ill patients.[2,3]

Contrast-induced nephropathy (CIN), or more contemporarily, contrast-associated acute kidney injury (CA-AKI), is generally defined as a ≥25% increase or ≥0.5 mg/dL rise in serum creatinine within 48-72 hours following contrast administration.[2] Over the past decade, the incidence of CA-AKI has decreased with the use of low-osmolar contrast agents, although the risk has not been entirely eliminated.[3-5] This remains clinically significant, especially among elderly patients with multiple comorbidities, particularly those with diabetes mellitus or chronic kidney disease.[2-4]

This study aimed to retrospectively evaluate the effects of contrast-enhanced imaging performed within the previous year on renal function, the need for hemodialysis, and mortality in patients hospitalized with a diagnosis of acute kidney injury (AKI) from the emergency department.

MATERIAL AND METHOD

Ethical approval was obtained from Hacıbektaş Veli University Non-Interventional Clinical Research Ethics Committee (Approval No: 2025/03, Date: 30/04/2025). All procedures were carried out in accordance with the ethical rules and the principles of the Declaration of Helsinki.

Data Collection and Analysis

This study was designed as a retrospective cross-sectional analysis. Data from patients admitted with a diagnosis of AKI to the ED of a public hospital between January 1, 2024, and December 31, 2024, were analyzed. Demographic characteristics, comorbidities, medication use, and laboratory parameters including urea, creatinine, eGFR (estimated glomerüler filtration rate), potassium, pH, HCO_3, and lactate were recorded. Types of contrast-enhanced imaging (CT, MRI, CAG) were documented, and the time interval from imaging to AKI diagnosis was calculated in days. Data were compared between patients who underwent contrast-enhanced imaging versus those who did not, and between survivors and non-survivors. To identify independent factors associated with the need for hemodialysis and mortality, multivariable logistic regression analysis was performed.

Statistical Analysis

Statistical analyses were performed using SPSS for Windows version 21.0. Descriptive statistics (frequency, percentage) were calculated. Normality of data distribution for continuous variables was assessed using the Kolmogorov–Smirnov and/or Shapiro–Wilk tests, along with visual inspection of histograms and Q–Q plots. Categorical variables were compared using the Chi-square test, and continuous variables were compared using Student's t-test or Mann–Whitney U test as appropriate. Results are presented as mean±standard deviation or frequency (percentage), and a p-value of <0.05 was considered statistically significant.

Study Limitations

This study has several important limitations. Due to its retrospective design and the limitations of electronic medical records, contrast exposure could not be comprehensively characterized. Information regarding the type of contrast agent (iso-osmolar or low-osmolar), administered dose, presence of repeated contrast exposure, and route of administration (intravenous versus intra-arterial) was not available for analysis. Consequently, contrast exposure was evaluated solely as a binary variable based on the presence or absence of a history of contrast-enhanced imaging, which limits assessment of dose–response relationships and differential effects on renal outcomes.

RESULTS

A total of 153 patients were evaluated in the study. Of these, 58.8% were male, and the mean age was 72.66±14.42 years (range: 21–98). The contrast-enhanced imaging group consisted of 44 patients (28.7%), while 109 patients (71.3%) were included in the non-contrast group. No significant differences were observed between the two groups in terms of age (p=0.835), sex (p=0.471), or age distribution (p=0.822). The most common comorbidities were hypertension (68.0%; p=0.705), diabetes mellitus (36.6%; p=0.862), and coronary artery disease (31.4%; p=0.180), with similar distributions between the contrast and non-contrast groups. Although the prevalence of malignancy was higher in the contrast group, this difference did not reach statistical significance (p=0.085) (**Table 1**).

Regarding medication use, the most frequently prescribed drugs were antihypertensives (60.8%; p=0.368), antibiotics (46.4%; p=0.077), and non-steroidal anti-inflammatory drugs (NSAIDs) (41.8%; p=0.283). There were no significant differences between the two groups in terms of medication use. Laboratory parameters, including urea (p=0.471), creatinine (p=0.239), estimated glomerular filtration rate (eGFR) (p=0.742), potassium (p=0.140), pH (p=0.129), and bicarbonate (HCO_3^-) levels (p=0.491),

Table 1. General characteristics and comparison of patients who underwent contrast-enhanced imaging versus those who did

Variables	General Data (n/%/mean) (min-max)	Non-Contrast-Enhanced Imaging (n/%/mean) (min-max)	Contrast-Enhanced Imaging (n/%/mean) (min-max)	Statistical Value**
Gender				
Male	90 (58.8)	66 (73.3)	24 (26.7)	x2=0.79. p=0.471
Female	63 (41.2)	42 (66.7)	21 (33.3)	
Age (average)	72.66±14.42 (21-98)	72.5±14.87 (21-98)	73.04±13.42 (35-98)	t=-0.208. p=0.835 df(151)
Age range				
18-35	4 (2.6)	3 (75)	1 (25)	
36-53	13 (8.4)	10 (76.9)	3 (23.1)	
54-71	39 (25.5)	25 (64.1)	14 (35.9)	x2=1.525. p=0.822
72-89	87 (56.9)	62 (72.3)	25 (28.7)	
90-107	10 (6.6)	8 (80)	2 (20)	
Comorbitidies				
Hypertension	104 (68)	72 (69.2)	32 (30.8)	x2=0.288. p=0.705
Diabetes mellitus	56 (36.6)	40 (71.4)	16 (28.6)	x2=0.030. p=0.862
Coronary artery diseases	48 (31.4)	30 (62.5)	18 (37.5)	x2=2.204. p=0.180
Congestive heart failure	12 (7.8)	7 (58.3)	5 (41.7)	x2=0.942. p=0.337
Cerebrovascular disease	8 (5.2)	5 (62.5)	3 (37.5)	x2=0.266. p=0.694
Chronic Obstructive Pulmonary Disease	11 (7.2)	7 (63.6)	4 (36.4)	x2=0.276. p=0.732
Malignancy	24 (15.7)	13 (54.2)	11 (45.8)	x2=3.697. p=0.085
Medications Used				
Antibiotics	71 (46.4)	45 (63.4)	26 (36.6)	x2=3.315. p=0.077
Anticoagulants	46 (30.1)	29 (63)	17 (37)	x2=1.803. p=0.183
Antihypertensives	93 (60.8)	63 (67.7)	30 (32.3)	x2=0.925. p=0.368
NSAID	64 (41.8)	42 (65.6)	22 (34.4)	x2=1.305. p=0.283
Corticosteroids	14 (9.2)	8 (57.1)	6 (42.9)	x2=1.342. p=0.355
Proton Pump Inhibitors	62 (40.5)	40 (64.5)	22 (35.5)	x2=1.851. p=0.207
Chemotherapy	17 (11.1)	9 (52.9)	8 (47.1)	x2=2.869. p=0.099
Others	96 (62.7)	67 (69.8)	29 (30.2)	x2=0.079. p=0.855
Laboratory Values				
Urea (mg/dL)	151.05±83.99 (47-469)	156.23±89.81 (47-469)	138.62±67.3(50-400)	t=-0.208. p=0.471
Creatinine (mg/dL)	4.45±3.42 (1.3-18.3)	4.39±3.57 (1.31-18.33)	4.59±3.06 (1.4-14.3)	t=1.183. p=0.239
eGFR (mL/dk/1.73m2)*	17.48±10.34 (0.7-49)	18.27±10.66 (2.6-49)	15.57±9.22 (0.7-42)	t=-0.329. p=0.742
Potassium (mmol/L)	4.9±1.2 (2.2-10)	5±1.2 (2.2-10)	4.67±1.16 (2.6-7.36)	t=1.485. p=0.140
pH	7.28±0.14 (6.6-7.7)	7.27±0.14 (6.6-7.54)	7.29±0.15 (6.68-7.77)	t=1.528.p=0.129
HCO_3 (mmol/L)	17.97±6.54 (1.3-41.7)	17.74±6.47 (1.3-41.7)	15.84±6.72 (3.85-38)	t=-0.961. p=0.491
Lactate (mmol/L)	3.21±3.19 (0.7-19.4)	2.88±2.28 (0.72-14.63)	4.05±4.63 (0.95-19.42)	t=-0.211. p=0.036

Table 1. General characteristics and comparison of patients who underwent contrast-enhanced imaging versus those who did (continued...)

Variables	General Data (n/%/mean) (min-max)	Non-Contrast-Enhanced Imaging (n/%/mean) (min-max)	Contrast-Enhanced Imaging (n/%/mean) (min-max)	Statistical Value**
Imagining type				
Computed Tomography	36 (81.8)	-	36 (81.8)	
Coronary Angiography	7 (15.9)	-	7 (15.9)	
Magnetic Rezonans Imaging	1 (2.3)	-	1 (2.3)	
Time from Imaging to AKI Diagnosis (days)	73.73±80.99 (1-313)	-	73.73±80.99 (1-313)	
Hemodialysis				
Performed	64 (41.8)	36 (56.3)	28 (43.8)	x2=10.895. p=0.001
Non-performed	89 (58.2)	72 (80.9)	17 (19.1)	
Mortality				
Survived	111 (72.5)	86 (77.5)	25 (22.5)	x2=9.244. p=0.005
Deceased	42 (27.5)	22 (52.4)	20 (47.6)	
Total	153 (100)	109 (71.3)	44 (28.7)	

* NSAID: Non-steroidal Anti-Inflammatory Drug, AKI: Acute kidney injury, eGFR: Estimated glomerüler filtration rate
Statistical Analysis: Descriptive statistics (frequency and percentage) were used, and the Chi-square test was employed for comparisons of categorical variables between the two groups. Independent groups were compared using the Student's t-test and/or the Mann-Whitney U test. Results are presented as mean±standard deviation or frequency (percentage), and a p-value < 0.05 was considered statistically significant with a 95% confidence interval.

were comparable between the contrast and non-contrast groups. However, lactate levels were significantly higher in patients who underwent contrast-enhanced imaging (p=0.036). The requirement for hemodialysis was significantly greater in the contrast group (p=0.001). Similarly, mortality rates were significantly higher among patients with contrast exposure (p=0.005). Among imaging modalities, computed tomography (CT) was the most frequently used (81.8%), followed by coronary angiography (15.9%) and magnetic resonance imaging (2.3%). The mean time from contrast exposure to the development of acute kidney injury was 73.7±80.9 days (range: 1–313) (**Table 1**).

In analyses stratified by mortality status, the mean age was significantly higher among deceased patients (p=0.000). The presence of hypertension (p=0.025), coronary artery disease (p=0.020), and cerebrovascular disease (p=0.006) was significantly associated with mortality. Anticoagulant use was also significantly more frequent among non-survivors (p=0.011). With respect to laboratory findings, deceased patients had significantly higher levels of urea (p=0.001), creatinine (p=0.011), potassium (p=0.001), and lactate (p=0.001), while eGFR (p=0.001), pH (p=0.001), and bicarbonate levels (p=0.038) were significantly lower. In addition, the requirement for hemodialysis was markedly higher among non-survivors (p=0.001). Contrast exposure was also significantly associated with mortality (p=0.003) (**Table 2**).

According to the results of the multivariable regression analysis performed for hemodialysis requirement and mortality, several variables were found to be statistically significant. In multivariable logistic regression analysis, lower eGFR (OR: 0.84, 95% CI: 0.76–0.94; p=0.001), higher potassium levels (OR: 2.06, 95% CI: 1.30–3.26; p=0.002), and contrast-enhanced imaging (OR: 5.10, 95% CI: 1.71–15.19; p=0.003) were identified as independent predictors of hemodialysis requirement. In multivariable logistic regression analysis, advanced age (OR: 1.11, 95% CI: 1.05–1.19; p=0.001), presence of cerebrovascular disease (OR: 17.32, 95% CI: 1.75–171.20; p=0.015), and requirement for hemodialysis (OR: 8.80, 95% CI: 2.13–36.40; p=0.003) were identified as independent predictors of mortality. Contrast-enhanced imaging was not independently associated with mortality after adjustment for confounding variables (p=0.141).

Table 3 details the 44 patients who underwent contrast-enhanced imaging. The majority had comorbid conditions including hypertension, diabetes mellitus, or coronary artery disease. Most underwent CT imaging (81.8%), with a mean eGFR of 15.6 mL/min/1.73 m^2 and mean creatinine of 4.59 mg/dL. Approximately half required hemodialysis, and 47.6% died during follow-up. Most deceased patients exhibited high lactate and low HCO_3 levels.

Tablo 2. Comparison of general data between deceased and surviving patients

Variables	General Data (n/%/ mean) (min-max)	Survived (n/%/mean) (min-max)	Deceased (n/%/ mean (min-max)	Statistical Value**
Gender				
Male	90 (58.8)	64 (71.1)	26 (28.9)	x2=0.227. p=0.387
Female	63 (41.2)	47 (74.6)	16 (25.4)	
Age (average)	72.66±14.42 (21-98)	70.17±14.85 (21-97)	79.26±10.82 (52-98)	t=-3.615. p=0.000
Age range				
18-35	4 (2.6)	4 (100)	0 (0)	
36-53	13 (8.4)	11 (84.6)	2 (15.4)	
54-71	39 (25.5)	32 (82.1)	7 (17.9)	x2=7.764. p=0.101
72-89	87 (56.9)	59 (67.8)	28 (32.2)	
90-107	10 (6.6)	5 (50)	5 (50)	
Comorbitidies				
Hypertension	104 (68)	70 (67.3)	34 (32.7)	x2=4.479. p=0.025
Diabetes mellitus	56 (36.6)	41 (73.2)	15 (26.8)	x2=0.020. p=0.522
Coronary artery diseases	48 (31.4)	29 (60.4)	19 (39.6)	x2=5.169. p=0.020
Congestive heart failure	12 (7.8)	8 (66.7)	4 (33.3)	x2=0.226. p=0.438
Cerebrovascular disease	8 (5.2)	2 (25)	6 (75)	x2=9.583. p=0.006
Chronic Obstructive Pulmonary Disease	11 (7.2)	9 (81.8)	2 (18.2)	x2=0.511. p=0.375
Malignancy	24 (15.7)	15 (62.5)	9 (27.5)	x2=1.443. p=0.070
Medications Used				
Antibiotics	71 (46.4)	49 (69)	22 (31)	x2=0.831. p=0.233
Anticoagulants	46 (30.1)	27 (58.7)	19 (41.3)	x2=6.339. p=0.011
Antihypertensives	93 (60.8)	64 (68.8)	29 (31.2)	x2=1.658. p=0.131
NSAID	64 (41.8)	45 (70.3)	19 (29.7)	x2=0.276. p=0.365
Corticosteroids	14 (9.2)	12 (85.7)	2 (14.3)	x2=1.341. p=0.203
Proton Pump Inhibitors	62 (40.5)	43 (69.4)	19 (30.6)	x2=0.534. p=0.291
Chemotherapy	17 (11.1)	11 (64.7)	6 (35.3)	x2=0.591. p=0.307
Others	96 (62.7)	67 (69.8)	29 (30.2)	x2=0.984. p=0.211

Tablo 2. Comparison of general data between deceased and surviving patients (continued...)

Variables	General Data (n/%/ mean) (min-max)	Survived (n/%/mean) (min-max)	Deceased (n/%/ mean (min-max)	Statistical Value**
Laboratory Values				
Urea (mg/dL)	151.05±83.99 (47-469)	134.36±75.06 (47-469)	195.16±91.03 (71-433)	t=-4.210. p=0.000
Creatinine (mg/dL)	4.45±3.42 (1.3-18.3)	4.02±3.19 (1.31-17.5)	4.02±3.19 (2-18.33)	t=-2.568. p=0.011
eGFR (mL/dk/1.73m2)*	17.48±10.34 (0.7-49)	19.43±10.28 (2.6-49)	5.59±3.77 (3-27)	t=-3.994. p=0.000
Potassium (mmol/L)	4.9±1.2 (2.2-10)	4.71±1.10 (2.2-8.4)	5.42±1.29 (2.7-10)	t=-3.393. p=0.000
pH	7.28±0.14 (6.6-7.7)	7.30±0.11 (7.06-7.54)	7.21±0.19 (6.6-7.49)	t=3.426. p=0.001
HCO3 (mmol/L)	17.97±6.54 (1.3-41.7)	18.64±6.10 (4.01-32.2)	16.20±7.35 (1.3-41.7)	t=2.088. p=0.038
Lactate (mmol/L)	3.21±3.19 (0.7-19.4)	2.46±1.36 (0.72-9.6)	5.19±5.22 (1.65-14.63)	t=-5.082. p=0.000
Time from Imaging to AKI Diagnosis (days)	73.73±80.99 (1-313)	82.64±75.60 (4-278)	62.60±87.95 (1-313)	t=0.822. p=0.416
Contrast-Enhanced Imaging				
Performed	45 (29.4)	25 (55.6)	20 (44.4)	x2=9.244. p=0.003
Non-performed	108 (69.6)	86 (79.6)	22 (20.4)	
Hemodialysis				
Performed	64 (41.8)	30 (46.9)	34 (53.1)	x2=36.415. p=0.000
Non-performed	89 (58.2)	81 (91)	8 (9)	
Total	153 (100)	111 (72.5)	42 (27.5)	

*NSAID: Non-steroidal anti-inflammatory drug; eGFR: Estimated glomerular filtration rate; Time Interval: Days between contrast-enhanced imaging and hospital admission with acute kidney injury diagnosis.
**Descriptive statistics (frequency, percentage) were used, and categorical variables were compared using the Chi-square test. Independent groups were compared using the Student's t-test and/or Mann–Whitney U test. Results are presented as mean±SD or frequency (percentage), and $p < 0.05$ was considered statistically significant with a 95% confidence interval.

Table 3. Detailed characteristics of patients exposed to contrast

			COMORBIDITES							MEDICATIONS USE								LABORATORY VALUES									
Patient number	Gender	Age	Hypertaension	Diabetes mellitus	Coronary artery disease	Congestive heart failure	Cerberovascular disease	Chronic Obstructive Pulmonary Disease	Malignancy	Antibiotics	Anticoagulants	Antihypertensives	NSAID*	Cortikostreroide	Proton Pump Inhibitors	Chemotherapy	Others	Urea	Creartinine	eGFR*	Potassium	pH	HCO3	Lactate	Imaginig Type*	Time from Imaging to AKI Diagnosis (days)*	Hemodialysis	Deceased
1	female	77	(+)	(+)	(-)	(-)	(-)	(-)	(-)	(+)	(+)	(+)	(-)	(-)	(-)	(-)	(+)	87	3.21	13	5.1	7.36	3.85	1.78	CT	1	(+)	(+)
2	male	81	(+)	(+)	(+)	(-)	(-)	(-)	(-)	(+)	(+)	(+)	(+)	(-)	(-)	(-)	(+)	182	7.84	5	6.9	6.89	9.2	18.5	CT	3	(+)	(+)
3	male	68	(+)	(+)	(+)	(+)	(-)	(-)	(-)	(+)	(+)	(+)	(+)	(-)	(+)	(-)	(+)	98	1.99	34	4.2	7.255	19.9	3.22	CAG	4	(-)	(-)
4	female	50	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(+)	(-)	(-)	(+)	(-)	(-)	(-)	(-)	115	2.78	19	3.6	7.18	18	1.21	CT	4	(+)	(-)
5	female	37	(-)	(-)	(-)	(-)	(-)	(-)	(+)	(-)	(-)	(-)	(-)	(-)	(-)	(+)	(+)	87	5.15	10	4	7.12	12	3.8	CT	5	(+)	(-)
6	male	75	(+)	(-)	(+)	(-)	(-)	(-)	(+)	(+)	(+)	(+)	(+)	(-)	(+)	(+)	(+)	299	5.92	9	4.6	7.125	8.9	2.28	CT	8	(+)	(+)
7	female	69	(+)	(-)	(+)	(+)	(-)	(-)	(-)	(-)	(-)	(+)	(-)	(-)	(-)	(-)	(-)	50	1.96	26	4	7.41	23	2.39	CAG	11	(-)	(-)
8	female	78	(+)	(+)	(+)	(-)	(-)	(-)	(-)	(-)	(-)	(+)	(-)	(-)	(-)	(-)	(-)	53	2.18	21	3.2	7.37	16.1	2.19	CT	12	(+)	(+)
9	male	87	(+)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(+)	(-)	(-)	(-)	(-)	(-)	183	2.77	20	6	7.13	18.5	2.43	CT	13	(-)	(-)
10	male	75	(+)	(-)	(-)	(-)	(-)	(-)	(+)	(-)	(-)	(+)	(-)	(-)	(-)	(-)	(-)	128	8.42	6	4.7	7.32	18	1.25	CT	13	(+)	(+)

Table 3. Detailed characteristics of patients exposed to contrast (continued...)

Patient number	Gender	Age	COMORBIDITES							MEDICATIONS USE								LABORATORY VALUES										
			Hypertaension	Diabetes mellitus	Coronary artery disease	Congestive heart failure	Cerberovascular disease	Chronic Obstructive Pulmonary Disease	Malignancy	Antibiotics	Anticoagulants	Antihypertensives	NSAID*	Cortikostreroide	Proton Pump Inhibitors	Chemotherapy	Others	Urea	Creartinine	eGFR*	Potassium	pH	HCO3	Lactate	Imaginig Type*	Time from Imaging to AKI Diagnosis (days)*	Hemodialysis	Deceased
11	female	69	(+)	(-)	(+)	(-)	(-)	(-)	(-)	(+)	(+)	(+)	(-)	(-)	(+)	(-)	(+)	90	3.45	17	3.4	7.35	19.8	1.73	CAG	15	(-)	(-)
12	male	68	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(+)	(-)	(-)	(+)	(-)	(-)	(-)	(-)	181	10.84	5	6.7	7.31	16.5	1.34	CT	15	(+)	(+)
13	female	84	(-)	(+)	(-)	(-)	(-)	(-)	(-)	(+)	(-)	(-)	(+)	(-)	(+)	(-)	(+)	62	1.44	34	4.33	7.42	19.4	1.24	CT	16	(-)	(-)
14	female	85	(-)	(-)	(+)	(+)	(-)	(-)	(-)	(-)	(+)	(-)	(+)	(-)	(-)	(-)	(+)	102	2.2	22	5	7.32	16.8	2.58	CT	18	(-)	(+)
15	female	84	(+)	(-)	(-)	(-)	(-)	(-)	(-)	(+)	(-)	(+)	(-)	(-)	(-)	(-)	(-)	237	10.37	3	5.5	7.23	13.9	3.05	CT	19	(+)	(+)
16	male	98	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(+)	(-)	(-)	(+)	(-)	(-)	(-)	(-)	172	4.57	10	4.3	7.21	18.1	9.66	CT	21	(+)	(+)
17	female	65	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(+)	(-)	(-)	(+)	(-)	(-)	(-)	(+)	105	6.79	6	4	7.31	23.5	2.18	CT	24	(+)	(+)
18	male	88	(+)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(+)	(-)	(-)	(-)	(-)	(-)	192	4.19	11.9	4.7	7.42	20.9	19.1	CT	24	(+)	(+)
19	male	87	(-)	(-)	(-)	(-)	(-)	(-)	(+)	(-)	(-)	(-)	(+)	(-)	(-)	(+)	(+)	149	2.32	18.4	3	7.25	16.8	3.84	CT	25	(-)	(-)
20	female	67	(+)	(+)	(+)	(-)	(-)	(-)	(-)	(-)	(+)	(+)	(-)	(-)	(+)	(-)	(+)	110	2.67	18	4.2	7.27	17.6	1.28	CT	26	(-)	(-)
21	male	51	(-)	(-)	(-)	(-)	(-)	(-)	(+)	(-)	(-)	(-)	(+)	(+)	(+)	(+)	(-)	177	10.67	0.7	5.7	7.42	21	5.14	CT	28	(+)	(+)
22	male	65	(+)	(+)	(+)	(-)	(-)	(-)	(-)	(-)	(+)	(+)	(+)	(-)	(+)	(-)	(+)	202	10.84	4	6.4	7.21	121	1.25	CAG	32	(+)	(+)
23	male	86	(+)	(-)	(+)	(-)	(-)	(-)	(+)	(+)	(-)	(-)	(-)	(-)	(-)	(+)	(+)	154	4.4	11.4	6.2	7.29	19	5.98	CT	34	(+)	(+)
24	male	77	(+)	(-)	(-)	(-)	(-)	(-)	(-)	(+)	(+)	(+)	(+)	(-)	(+)	(-)	(-)	136	2.6	22.9	4.7	7.31	14.6	6.8	CT	39	(-)	(-)
25	male	71	(+)	(+)	(-)	(-)	(-)	(-)	(-)	(+)	(-)	(-)	(-)	(-)	(-)	(-)	(+)	73	2.56	24	6.6	7.35	20.1	1.91	CT	64	(-)	(-)
26	female	75	(+)	(+)	(+)	(-)	(-)	(+)	(-)	(+)	(-)	(+)	(+)	(-)	(-)	(-)	(+)	179	3.76	13	5.5	7.31	18.6	2.8	CT	66	(+)	(-)
27	female	57	(+)	(+)	(+)	(-)	(-)	(-)	(-)	(+)	(+)	(+)	(+)	(-)	(+)	(-)	(+)	144	5.63	8	4.1	7.35	14.3	2.85	CAG	67	(+)	(-)
28	male	71	(+)	(-)	(-)	(-)	(-)	(-)	(+)	(+)	(-)	(+)	(+)	(-)	(+)	(+)	(-)	133	3.6	16.2	4.3	7.5	24.2	6.87	CT	68	(+)	(-)
29	female	57	(-)	(-)	(-)	(-)	(-)	(-)	(+)	(-)	(-)	(-)	(+)	(-)	(+)	(+)	(+)	73	1.87	30	2.6	7.77	38	5.59	CT	68	(-)	(-)
30	female	84	(+)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(+)	(+)	(-)	(-)	(-)	(-)	111	2.57	17	5	7.21	11.4	19.42	CAG	72	(+)	(+)
31	female	77	(+)	(+)	(-)	(-)	(-)	(-)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(-)	(+)	66	2.21	22	4.8	7.42	26.9	1.69	CT	78	(-)	(-)
32	male	79	(+)	(-)	(-)	(-)	(+)	(-)	(-)	(-)	(+)	(+)	(-)	(-)	(+)	(-)	(+)	249	2.76	21	6	7.4	24.4	2.04	CT	81	(+)	(+)
33	male	91	(-)	(-)	(+)	(-)	(+)	(-)	(-)	(-)	(+)	(-)	(-)	(-)	(+)	(-)	(+)	104	1.44	42	4.9	7.31	21.1	1.9	MRI	86	(-)	(+)
34	female	54	(+)	(-)	(+)	(-)	(-)	(-)	(-)	(+)	(-)	(+)	(+)	(-)	(+)	(-)	(-)	98	3.27	15	7.36	6.68	20.6	1.9	CT	96	(+)	(-)
35	male	35	(+)	(-)	(-)	(-)	(-)	(-)	(-)	(+)	(-)	(+)	(+)	(-)	(-)	(-)	(-)	101	8.59	7	4.2	7.34	18.6	1.98	CT	116	(+)	(-)
36	female	74	(+)	(-)	(-)	(-)	(-)	(-)	(-)	(+)	(-)	(+)	(-)	(+)	(+)	(-)	(+)	127	6.87	5	4.4	7.32	19.7	1.55	CT	123	(+)	(-)
37	male	84	(+)	(-)	(+)	(-)	(-)	(-)	(-)	(-)	(+)	(+)	(-)	(-)	(+)	(-)	(+)	106	4.15	12	3.8	7.29	14.3	2.63	CAG	131	(+)	(-)
38	male	66	(-)	(-)	(-)	(-)	(-)	(+)	(-)	(+)	(-)	(-)	(-)	(+)	(+)	(-)	(+)	119	2.91	21	2.6	7.35	38	2.58	CT	168	(-)	(-)
39	male	79	(+)	(-)	(-)	(-)	(-)	(-)	(+)	(-)	(-)	(+)	(-)	(-)	(-)	(+)	(+)	113	3.49	16	3.8	7.4	22.6	1.82	CT	173	(+)	(-)
40	male	80	(+)	(+)	(-)	(+)	(+)	(-)	(-)	(+)	(+)	(+)	(+)	(+)	(+)	(-)	(+)	125	2.3	26	3.81	7.38	30.8	1.65	CT	187	(-)	(-)
41	female	76	(+)	(+)	(+)	(-)	(-)	(-)	(+)	(+)	(+)	(+)	(-)	(-)	(+)	(-)	(+)	400	6.24	6	4.6	7.27	4.58	12.2	CT	192	(+)	(+)
42	female	78	(-)	(+)	(+)	(-)	(-)	(+)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	67	3.5	12	2.8	7.21	16	1.28	CT	225	(+)	(-)
43	male	62	(+)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(+)	(-)	(-)	(-)	(-)	(+)	152	14.3	3.3	5.8	7.24	13.8	0.95	CT	256	(+)	(+)
44	female	80	(+)	(+)	(-)	(-)	(-)	(-)	(-)	(+)	(-)	(+)	(-)	(-)	(+)	(-)	(+)	136	2.35	19	3.48	7.31	17.5	2.8	CT	278	(-)	(-)
45	male	86	(+)	(+)	(+)	(+)	(-)	(+)	(-)	(+)	(+)	(+)	(-)	(+)	(+)	(-)	(+)	211	2.99	18	5.6	7.36	21.5	1.77	CT	313	(-)	(+)

*NSAID: Non-steroidal anti-inflammatory drug; eGFR: Estimated glomerular filtration rate; Time elapsed: Number of days between contrast-enhanced imaging and hospitalization with acute kidney injury diagnosis; CAG: Coronary angiography; CT: Computed tomography

DISCUSSION

This study retrospectively examined the effects of contrast-enhanced imaging on renal function, hemodialysis requirement, and mortality in patients admitted with AKI. Our findings indicate that contrast exposure is associated with increased hemodialysis and mortality rates, but not with significant differences in primary renal function parameters (eGFR, creatinine, urea). These results suggest that comorbidities and clinical severity, rather than contrast itself, are the main determinants of long-term renal outcomes.

McDonald et al.[6] demonstrated that intravenous contrast exposure is not an independent risk factor for dialysis or mortality, although caution is advised in high-risk patient subgroups. Our findings align with this, indicating higher mortality in the contrast group largely related to systemic disease burden rather than renal parameters.

Contrast-enhanced imaging is often unavoidable in critical ED patients, particularly for trauma, sepsis, pulmonary embolism, mesenteric ischemia, or suspected cardiac events, where it substantially improves diagnostic accuracy (4). Literature suggests that in these contexts, CA-AKI is mostly attributable to the underlying condition rather than contrast exposure.[7] Davenport et al.[3] emphasized that intravenous contrast risk is often overestimated, and low-osmolar contrast agents with adequate hydration are generally safe.[3] Our findings, showing no significant differences in eGFR, creatinine, or urea, support this perspective.

The significantly elevated lactate levels in contrast-exposed patients are notable. Park et al. identified serum lactate as an independent predictor of CA-AKI and mortality in ED patients undergoing contrast CT.[8] Similarly, Jin et al.'s meta-analysis of 52 studies highlighted increased CA-AKI incidence among patients with hemodynamic instability and elevated lactate.[5] These results are consistent with our observation of high lactate correlating with mortality.

Older age and comorbidities such as hypertension, coronary artery disease, and cerebrovascular disease were associated with mortality in our cohort. Literature indicates that age, diabetes mellitus, heart failure, and pre-existing chronic kidney disease are major risk factors for CA-AKI, and also contribute to higher mortality.[9,10] Therefore, the observed relationship between contrast exposure and mortality likely reflects cumulative effects of these risk factors rather than direct contrast nephrotoxicity.

Recent studies report that CA-AKI incidence is lower than previously estimated. Liu et al. found similar mortality rates between contrast-exposed and non-exposed AKI patients.[9] Hinson et al. reported <2.7% AKI incidence after contrast CT in the ED, mainly linked to underlying clinical conditions.[4] Our results are consistent, supporting that contrast alone does not cause long-term renal dysfunction.

Higher hemodialysis requirements in the contrast group indicate more severe clinical conditions. CA-AKI requiring dialysis is often associated with multi-organ dysfunction, sepsis, or advanced age.[11] The 2023 KDIGO guideline recommends isotonic hydration as the most effective preventive strategy, with pharmacological agents offering limited benefit.[12] Our study could not assess hydration or prophylactic measures due to lack of standardization.

Recent literature suggests that renal toxicity from low-osmolar intravenous contrast is likely overestimated, with temporary eGFR declines returning to baseline within 72 hours.[11] McDonald et al. also reported no significant relationship between contrast exposure and long-term dialysis or mortality.[6] These findings support our observation of unchanged renal parameters in the contrast group.

Among deceased patients, significantly lower eGFR and higher urea, creatinine, and potassium levels were expected, reflecting AKI severity. The strong association of elevated lactate with mortality underscores the prognostic role of sepsis and hypoperfusion in AKI, consistent with recent studies using lactate as a biomarker.[13,14]

Our findings suggest that unnecessary concerns regarding contrast use in clinical practice should be reduced. In EDs where time is critical, delaying essential contrast-enhanced imaging may increase mortality more than the contrast itself. Clinicians should not postpone necessary imaging due to fear of CA-AKI, but careful hydration and close monitoring are recommended for high-risk groups (eGFR <30 mL/min, advanced age, diabetic nephropathy).[15-18]

Limitations include the single-center, retrospective design, lack of standardized contrast dose/type, and missing hydration data, which limit causal inference. The relatively small sample size also reduces statistical power. Prospective multicenter studies with larger cohorts are needed to validate these findings.

CONCLUSION

Overall, although patients with AKI who underwent contrast-enhanced imaging had higher mortality and dialysis rates, these outcomes appear primarily related to clinical severity and comorbidities rather than direct nephrotoxic effects of contrast. These findings align with recent literature. Safe use of low-osmolar contrast media, adequate hydration, proper indications, and clinical vigilance can minimize the risk of contrast-associated kidney injury.

ETHICAL DECLARATIONS

Ethics Committee Approval: Ethical approval was obtained from Hacıbektaş Veli University Non-Interventional Clinical Research Ethics Committee (Approval No: 2025/03, Date: 30/04/2025).

Informed Consent: Written informed consent was obtained from patients.
Referee Evaluation Process: Externally peer-reviewed.
Conflict of Interest Statement: The authors have no conflicts of interest to declare.
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