

ORIGINAL ARTICLE

A Rare Diagnosis in the Emergency Department: Renal Infarction

Acil Bölümünde Nadir Bir Tanı: Renal Enfarktüs

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ABSTRACT

Objective: Renal infarction (RI), which is caused by sudden cessation of renal blood flow, is a rare disease. In this study, we planned to investigate the demographic and clinical characteristics and outcomes of patients diagnosed with renal infarction in the emergency department.

Material and Methods: Patients over the age of 18 who presented to the emergency department with abdominal/flank pain, nausea, and vomiting between 2010 and 2021 and were diagnosed with acute renal infarction in contrast-enhanced abdominal computed tomography were included in the study. The data of the patients were reviewed retrospectively. Demographic and clinical characteristics, as well as laboratory results of the patients, were recorded.

Results: A total of 38 patients were included in the study. The mean age of the patients was 61.8±18 years and 63.2% (n=24) were male. The most common complaints of the patients were abdominal pain (84.2%), flank pain (68.4%), and nausea-vomiting (50%). More rarely, patients complained about chest pain, dyspnea, and fever. Acute renal failure developed in 4 patients (10.5%). While only three (7.9%) of the patients had no known disease, the others had comorbidities such as hypertension (31.6%), ischemic heart disease (31.6%), previous thromboembolic events (31.6%), diabetes (26.3%), cancer (23.7%), heart failure (21.1%), and atrial fibrillation (18.4%). The most common cause of RI was cardioembolic events (44.7%), followed by hypercoagulability (28.9%), renal artery damage (15.8%), and idiopathic causes (10.5%).

Conclusion: Acute RI is a disease that is rarely detected in the emergency department. Because there is a lack of specific clinical findings, it is often overlooked or diagnosed late. Delay in diagnosis can significantly cause morbidity and mortality. The diagnosis of acute RI should be considered especially in patients with a high risk of thromboembolism and who present to the emergency department with complaints of unexplained abdominal or flank pain.

Anahtar Kelimeler: renal, infarction, emergency, department

ÖZ

Amaç: Renal kan akımının ani kesilmesi sonucu oluşan renal enfarktüs (RE), nadir görülen bir hastalıktır. Bu çalışmada acil bölümünde RE tanısı konulan hastaların demografik ve klinik özellikleri ve sonuçlarını araştırmayı planladık.

Gereç ve Yöntem: 2010-2021 yılları arasında karın/yan ağrısı, bulantı, kusma şikayeti ile acil servise başvuran ve çekilen kontrastlı batin bilgisayarlı tomografisinde akut renal enfarktüs tanısı konulan 18 yaşından büyük hastalar çalışmaya dahil edildi. Hastaların verileri retrospektif tarandı. Hastaların demografik, klinik özellikleri ve laboratuvar sonuçları kaydedildi.

Bulgular: Çalışmaya 38 hasta dahil edildi. Hastaların ortalama yaşı 61.8±18 idi ve % 63.2'si (n=24) erkekti. Hastaların en sık şikayetleri karın ağrısı (%84.2), yan ağrısı (%68.4) ve bulantı-kusma (%50) idi. Daha nadir olarak göğüs ağrısı, dispne ve ateş vardı. 4 hastada (%10.5) akut böbrek yetmezliği gelişti. Hastaların sadece üçünde (%7.9) bilinen bir hastalık yok iken diğerlerinde hipertansiyon (%31.6), iskemik kalp hastalığı (%31.6), geçirilmiş tromboembolik olaylar (%31.6), diyabet (%26.3), kanser (%23.7), kalp yetmezliği (%21.1) ve atriyal fibrilasyon (%18.4) gibi eşlik eden önemli hastalıklar vardı. RE'e neden olan en sık neden kardiyembolik olaylar (% 44.7) iken bunu sırası ile hiperkoagülabilité (%28.9), renal arter hasarı (%15.8) ve idiyopatik nedenler (%10.5) izledi.

Sonuç: Akut RE acil bölümünde nadiren tespit edilen bir hastalık olup spesifik klinik bulguları olmaması nedeniyle sıklıkla gözden kaçırılabilir veya geç tanı konur. Tanıdaki gecikme önemli morbidite ve mortaliteye neden olabilir. Özellikle tromboembolizm riski yüksek olan ve açıklanamayan karın ağrısı, yan ağrısı şikayeti ile acil bölümüne başvuran hastalarda akut RE tanısı akla gelmelidir.

Anahtar Kelimeler: renal, enfarktüs, acil, bölümü

Introduction

Renal infarction (RI) is a rare condition that occurs as a result of obstruction or decrease in renal arterial flow (1), and its incidence is 0.004-0.007% in admissions to the emergency department (2). It has no disease-specific signs, symptoms, or laboratory value. Patients mostly present with complaints such as flank pain, abdominal pain, nausea, and vomiting (3,4). Rarely, they may present with fever, uncontrolled hypertension, and acute renal failure (5). It mimics clinical acute pyelonephritis, renal colic, rupture of aortic aneurysm, and other diseases that cause acute abdomen (3,4). Diagnosis is difficult due to the rarity of the disease and the presence of signs and

symptoms that mimic other diseases. Delay in diagnosis may lead to loss of kidney functions as well as death (2,4). Therefore, early clinical suspicion and necessary investigations are important. The diagnosis of RI is made by contrast-enhanced computed tomography (CT), renal perfusion scintigraphy, magnetic resonance imaging, and/or angiography. CT has replaced renal angiography because of its applicability and accessibility (6). Apart from diagnosing the disease, CT plays a role in determining the extent and etiology of the disease. Wedge-shaped hypodense areas are typically observed in the kidney (4). In our study, we planned to investigate the demographic and

clinical characteristics and outcomes of patients who presented to the emergency department with complaints of abdominal and flank pain and were diagnosed with RI on contrast-enhanced CT.

Materials and Methods

In this retrospective study, patients older than 18 years of age who presented to the emergency department with complaints of abdominal/flank pain, nausea, and vomiting between January 1, 2010 and December 31, 2021 and were diagnosed with acute renal infarction with a typical radiological image on contrast-enhanced abdominal CT were included in the study. Demographic data, clinical findings, and laboratory values of all patients at the time of admission to the emergency department were recorded. Patients with missing data in the file scan, patients who were not hospitalized for different reasons after diagnosis and could not be followed up, and patients younger than 18 years of age were excluded from the study. The patients were divided into 4 groups according to the etiology: cardioembolic group, hypercoagulation group, renal artery damage group, and idiopathic group.

Statistical Package for the Social Sciences (SPSS v.22, Chicago, IL, USA) package program was used for statistical analysis. Data were analyzed using descriptive statistics. Quantitative variables were given as mean \pm standard deviation, and categorical variables were given as ratios.

This study was approved by the Firat University Ethics Committee (2022 /02-13) and conducted in accordance with the Declaration of Helsinki.

Results

A total of 38 patients were included in the study. The mean age of the patients was 61.8 ± 18 years and 63.2% (n=24) were male. Only three of the patients (7.9%) had no known disease. In others, the major potential risk factors were hypertension (31.6%), ischemic heart disease (31.6%), previous thromboembolic events (31.6%), diabetes (26.3%), cancer (23.7%), heart failure (21.1%), and atrial fibrillation (18.4%). In addition, 6 patients (15.8%) had mesenteric ischemia with renal infarction, and 4 patients (10.5%) had splenic infarction with renal infarction.

The most common complaints of the patients at the time of admission to the emergency department were abdominal pain (84.2%), flank pain (68.4%), and nausea-vomiting (50%). More rarely, there was chest pain, dyspnea, and fever. Acute renal failure (ARF) developed in 4 patients (10.5%). Three patients had chronic renal failure.

Renal infarction was in the left kidney in 52.6% (n=20) of the patients, in the right kidney in 42.1% (n=16), and bilateral in 5.3% (n=2). Demographic data and clinical

characteristics of the patients are given in Table 1.

Table 1: Demographic and clinical characteristics of the patients

Age mean \pm SD	61.8 \pm 18
Gender	% (n)
• Female	36.8 (14)
• Male	63.2 (24)
Comorbidity	% (n)
• Ischemic Heart Disease	31.6 (12)
• Hypertension	31.6 (12)
• Previous Thromboembolic Event	31.6 (12)
• Diabetes	26.3 (10)
• Cancer	23.7 (9)
• Heart Failure	21.1 (8)
• Atrial Fibrillation	18.4 (7)
• Hyperlipidemia	13.2 (5)
• Valvular Heart Disease	7.9 (3)
Symptoms and Findings	% (n)
• Abdominal pain	84.2 (32)
• Flank pain	68.4 (26)
• Nausea-vomiting	50 (19)
• Chest pain	13.2 (5)
• Dyspnea	7.9 (3)
• Fever	7.9 (3)
Localization	% (n)
• Left	52.6 (20)
• Right	42.1 (16)
• Bilateral	5.3 (2)
Etiology	% (n)
• Cardioembolic	44.7 (17)
• Hypercoagulability	28.9 (11)
• Renal Artery Damage	15.8 (6)
• Idiopathic	10.5 (4)

When the laboratory values of the patients were examined, the mean leukocyte value was $11.74 \pm 0.86 \times 10^3/\mu\text{L}$, urea 50.6 ± 5 mg/dL, creatin 1.3 ± 0.2 mg/dL, and lactate dehydrogenase (LDH) level was 403.9 ± 42.2 u/L. Laboratory parameters of the patients are given in Table 2.

Table 2: Laboratory parameters of the patients

Blood Analysis	
Leukocyte (n=38) Mean±SD	11.74 ± 0.86
• Elevated Leukocyte n (%)	25 (65.8)
Range: 3.8-8.6 10e3/ μ L	
Hemoglobin (n=38) Mean±SD g/dL	13.02 ± 0.36
Hematocrit (n=38) %	39.9±1.1
Urea (n=38) Mean±SD	50.6±5
• Elevated Urea n (%)	11 (28.9)
Range: 10-50 mg/Dl	
Creatine (n=38) Mean±SD	1.3±0.2
• Elevated Creatine n (%)	10 (26.3)
Range: 0.6-1.2 mg/dL	
eGFR (n=38) Mean±SD	70.9±3.3
mL/min/1.73 m ²	
Lactate dehydrogenase (n=35) Mean±SD	403.9±42.2
• Elevated LDH n (%)	30 (78.9)
Range: 120-246 u/L	
AST (n=37) Mean±SD	44.7±5.5
• Elevated AST n (%)	15 (39.5)
Range: 5-40 U/L	
ALT (n=37) Mean±SD	36.3±4.6
• Elevated ALT n (%)	10 (29.4)
Range: 5-40 U/L	
D-Dimer (n=5) Mean±SD	4.3±3.01
• Elevated D-Dimer n(%)	5 (100)
Range: 0-0.55 mg/L	
Urine Analysis	
Hematuria (n=32)	21 (65.6)
Proteinuria (n=32)	7 (21.8.)

eGFR: Estimated glomerular filtration rate, AST: Aspartate Aminotransferase, ALT: Alanine aminotransferase

In-hospital mortality developed in 15.8 (n=6) of the patients. RI was not the only cause of death in any of the patients who died. The patients had significant comorbidities that caused death.

When the etiological causes of RI were examined, the most common cardioembolic causes (44.7%) were observed, followed by hypercoagulation (28.9%), renal artery damage (15.8%), and idiopathic causes (10.5%). The mean age of the group with renal artery damage was lower than the other groups. Two patients with in-hospital mortality were in the cardioembolic group, while four were in the hypercoagulation group. Two of the patients who developed ARF were in the cardioembolic group, while the others were in the hypercoagulation group. Table 3 shows the clinical characteristics of the groups according to the etiological causes of RI.

Table 3: Clinical characteristics of patients according to etiological causes

Etiological Causes	Cardioembolic n=17	Hypercoagulability n=11	Renal Artery Damage n=6	Idiopathic n=4
Age mean±SD	69±14.5	66±14.2	36±12	57±17
In-hospital Mortality (n)	2	4	0	0
ARF (n)	2	2	0	0
Comorbidity (n)				
Ischemic Heart Disease	11	1	0	0
Hypertension	7	3	2	0
Previous Thromboembolic Event	5	7	0	0
Diabetes	7	3	0	0
Cancer	1	8	0	0
Heart Failure	7	1	0	0
Atrial Fibrillation	4	0	0	0
Hyperlipidemia	4	1	0	0
Valvular Heart Disease	3	0	0	0
Urea mean±SD	59.5±38.9	48.2±24.4	33.8±12.2	45±17.5
Creatine mean±SD	1.2±0.8	1.7±1.4	1±0.4	0.9±0.4
eGFR mean±SD	68±23.4	69±18.8	81±14.9	75±17.4

ARF: Acute Renal Failure, eGFR: Estimated glomerular filtration rate

Discussion

In this study, we investigated the clinical features, etiology, and outcomes of the patients diagnosed with RI in the emergency department. The mean age of the patients was 61.8 and 63.2% were male. While only three (7.9%) of the patients included in the study had no known disease, the other patients had important diseases such as ischemic heart disease, heart failure, cancer, or cardiovascular risk factors such as diabetes, hypertension, and hyperlipidemia. We found that cardioembolic causes most frequently lead to RI. Patients frequently presented to the emergency department with complaints such as abdominal pain, flank pain, nausea, and vomiting.

There are no specific signs and symptoms for RI. While the main complaints of patients are flank pain, abdominal pain, nausea, and vomiting (5-7), they may rarely present with sudden high blood pressure and acute kidney failure (1,7). In our study, the most common complaints of the patients at admission were abdominal pain (84%), flank pain (68.4%), and nausea/vomiting (50%), consistent with the literature. More rarely, they presented with chest pain (13.2%), dyspnea (7.9%), and fever (7.9%).

Although there is no specific laboratory parameter for RI, it has been reported in previous studies that

leukocytosis, increased lactate dehydrogenase (LDH), and hematuria can be observed (6,8). Serum LDH level is a marker of cell necrosis (9). While the LDH level is generally within the normal range in pyelonephritis and renal colic, which are conditions that can be confused with the diagnosis of RI, it increases in patients with renal infarction (6). In this study, 78.9% of patients had increased LDH levels and 65.8% had leukocytosis. D-dimer level was measured in only five patients at the time of emergency admission and was found to be high in all of them. Of the 32 patients whose urine analysis was performed, 65.6% had hematuria and 21.8% had proteinuria. Proteinuria and hematuria in RI patients are thought to occur as a result of glomerular and tubular necrosis. It has been shown that there is a positive correlation between proteinuria with the size of the kidney infarction and the formation of acute kidney injury (10).

In studies, the incidence of ARF has been reported to vary between 0-60% in RI patients (2). It is associated with pre-existing chronic renal failure, the volume of the infarct, the presence of microscopic hematuria, and renal failure at an advanced age (2,10). In this study, ARF developed in four (10.5%) of the patients. While only one of these patients had ARF at the time of admission to the emergency department, it developed during their follow-up in the others. Two patients with ARF also developed RI due to mesenteric artery occlusion, while the other had decompensated heart failure and ischemic heart disease. Two of the patients required hemodialysis. Three patients had known chronic renal failure.

The main causes of RI have been classified as cardioembolic, hypercoagulability, renal artery damage, and idiopathic causes (9). In this study, the most common causes of RI were cardioembolic causes (44.7%). Hypercoagulability, renal artery damage, and idiopathic causes followed. The age of the patients who developed RI due to renal artery damage was younger than the others. The urea ($p=0.331$), creatine ($p=0.644$) and GFR ($p=0.462$) values of the patients did not differ significantly between the groups. In-hospital mortality and ARF developed only in the cardioembolic and hypercoagulation groups. Cardiovascular risk factors such as hypertension, diabetes and hyperlipidemia were more common in RI caused by cardioembolic causes. Cardioembolic causes have been shown to be the most common cause of RI both in our country (7) and worldwide (3,6,11). Atrial fibrillation is an important risk factor for RI and increases the risk of RI in middle-aged patients (7,11). Studies have reported different rates of atrial fibrillation ranging between 18-48% in RI patients (4,9-11). In our study, approximately one third of the patients had hypertension and ischemic heart disease, 21% had heart failure and 18.4% had atrial fibrillation.

In our study, hypercoagulation was the second most common cause of RI (34.2%). One of the patients had protein C deficiency, which led to hypercoagulation.

In addition, two patients had a recently diagnosed Covid-19 infection. It is known that the susceptibility to hypercoagulation increases in Covid 19 infections (12). One of the patients presented to the emergency department with the complaint of flank/abdominal pain on the 4th day of the Covid infection and was diagnosed with RI. The patient had no known disease before. The second patient who was diagnosed with Covid infection a month ago had diabetes and hypertension. The patient also had mesenteric artery occlusion and had splenic infarction with bilateral RI. The remaining patients had a diagnosis of cancer.

In this study, the RI rate due to renal artery damage was 15.8%. Four (10.5%) of the patients developed RI due to trauma, while others developed RI due to dissection/aneurysm. Similar to our study, Eren et al. (7) found that the etiology was trauma in 7% of RI patients. In our study, the etiology was unclear in 13% of the patients. ARF and in-hospital mortality did not develop in any of the patients who developed RI due to renal artery damage and idiopathic causes.

During follow-up, in-hospital mortality occurred in six (15.8%) of the patients. All of these patients had significant comorbidities that caused death. Five of the patients had cancer. Three of these five patients developed mesenteric artery occlusion with RI, pulmonary embolism in one, and cerebrovascular disease in one. The other patient died due to mesenteric ischemia and multiorgan failure developed during Covid-19 infection. RI was not the main cause of death in any of the patients with a mortal course.

There is no standard treatment for RI, and the treatment varies according to the underlying etiology. While patients are usually treated conservatively with thrombolytic or anticoagulant drugs together with the treatment of the underlying disease, surgical treatment is less frequently used (2, 13). In this study, all patients underwent conservative treatment except one with aortic dissection.

Limitations

The present study has several limitations. First, the study was retrospective and some laboratory data were missing. Second, long-term follow-up of patients' kidney function was not performed.

Conclusion

Diagnosis of RI can be difficult because it is rare and the clinic mimics other common pathologies. Since the delay in diagnosis can lead to significant morbidity and mortality, renal infarction should also be considered in the differential diagnosis of patients who come to the emergency department with complaints of flank or abdominal pain and have an underlying risk factor, especially in terms of cardioembolic or hypercoagulation status.

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The author has no conflict of interest

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