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Detecting acute spontaneous isolated renal artery dissection with contrast enhanced multidetector computed tomography

Kontrastlı çok dedektörlü bilgisayarlı tomografi ile akut spontan izole renal arter diseksiyonunun saptanması

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Abstract

Purpose: Spontaneous isolated renal artery dissection is a very rare but threatening condition that can be difficult to diagnose early due to nonspecific symptoms. The goal of this study is to evaluate the incidence and multidetector computed tomography (MDCT) findings of this rare and important condition.

Materials and methods: We retrospectively examined the images of all patients who underwent contrast enhanced abdominal MDCT scans due to various abdominal complaints between July 2017-July 2020. 14000 contrast enhanced MDCT scans were evaluated. Only the isolated renal artery dissections without aortic involvement were included. Age, gender, symptoms, presence of thrombosis or renal parenchymal ischemia-infarct were noted. Average extension of dissection and distance from origin were measured.

Results: 8 (0.054%) patients had spontaneous isolated renal artery dissection (5M, 3F, age range 43-61 years). The mean distance from origin was 3.7 cm and the average extension was 3.8 cm. 3 patients had kidney infarct with a focal area of decreased perfusion. Only 1 patient underwent digital subtraction angiography. Patients were started on an anticoagulation therapy. No surgical or interventional therapy was deemed necessary. Dissections completely disappeared in patients who could undergo follow-up MDCT.

Conclusion: Spontaneous isolated renal artery dissection is a very rare condition. The etiology is not well known. The initial symptoms are generally nonspecific such as severe upper abdomen or flank pain. There are several treatment options available such as medical, surgical or interventional managements. Early diagnose is important to prevent complications. It should be considered in patients with new-onset flank or abdominal pain.

Key words: Renal artery dissection, isolated, spontaneous, computed tomography.

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Öz

Amaç: Spontan izole renal arter diseksiyonu, spesifik olmayan semptomlar nedeniyle erken teşhis edilmesi zor olabilen, çok nadir fakat tehdit edici bir durumdur. Bu çalışmanın amacı, bu nadir ve önemli durumun insidansını ve çok kesitli bilgisayarlı tomografi (ÇKBT) bulgularını değerlendirmektir.

Gereç ve yöntem: Temmuz 2017-Temmuz 2020 tarihleri arasında çeşitli karın şikayetleri nedeniyle kontrastlı abdominal ÇKBT taraması yapılan tüm hastaların görüntülerini retrospektif olarak inceledik. 14000 kontrastlı ÇKBT görüntüsü değerlendirildi. Sadece aort tutulumu olmayan izole renal arter diseksiyonları dahil edildi. Yaş, cinsiyet, semptomlar, tromboz veya renal parankimal iskemi-enfarkt varlığı kaydedildi. Ortalama diseksiyon uzunluğu ve orijinden uzaklık ölçüldü.

Bulgular: 8 (%0,054) hastada spontan izole renal arter diseksiyonu (5E, 3K, yaş aralığı 43-61) vardı. Orjinden ortalama uzaklık 3,7 cm ve ortalama diseke segment uzunluğu 3,8 cm idi. 3 hastada böbrekte parankimal enfarkt vardı. Sadece 1 hastaya dijital substraksiyon anjiyografisi yapıldı. Hastalara antikoagülan tedavi başlandı. Cerrahi veya girişimsel tedaviye gerek görülmedi. ÇKBT takibi yapılabilen hastalarda diseksiyonlar tamamen kayboldu.

Sonuç: Spontan izole renal arter diseksiyonu çok nadir görülen bir durumdur. Etiyoloji iyi bilinmemektedir. İlk semptomlar genellikle nonspesifik olup şiddetli karın veya yan ağrısıdır. Tıbbi, cerrahi veya girişimsel yönetimler gibi çeşitli tedavi seçenekleri mevcuttur. Erken teşhis, komplikasyonları önlemek için önemlidir. Yeni başlayan böğür veya karın ağrısı olan hastalarda düşünülmelidir.

Anahtar kelimeler: Renal arter diseksiyonu, izole, spontan, bilgisayarlı tomografi.

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Introduction

Isolated spontaneous renal artery dissections (SIRAD) are very rare entities. They can be a result of several underlying diseases such as atherosclerosis, malignant hypertension, fibromuscular dysplasia, and connective tissue disorders. Or they can be idiopathic without known of underlying pathology [1]. Nonspecific symptoms such as flank pain or hematuria leads to delay in the diagnosis. Gray scala and doppler ultrasound findings are insufficient for determining dissection. Contrast enhanced multidetector computed tomography (MDCT) or computed tomography angiography (CTA) can be performed for diagnosis. Digital subtraction angiography (DSA) is the gold standart imaging modality. Early diagnosis is important for preventing unnecessary medications or surgeries. Medical management or endovascular interventions are performed for treatment [2-5].

The aim of this study is to evaluate the incidence and MDCT findings of this rare and important condition.

Materials and methods

We retrospectively examined the images of all patients who underwent contrast enhanced abdominal MDCT scan due to various abdominal complaints from July 2017 to July 2020 at our radiology department. 14000 contrast enhanced MDCT scans were evaluated. Only the isolated renal artery dissections without aortic involvement were included. Aortic dissections with renal artery involvement, unenhanced MDCT images, scans with poor image quality were excluded. Patients with renal trauma were also excluded. Age, gender, symptoms, presence of thrombosis or renal parenchymal ischemia-infarct were noted. Average extension of dissection and distance from origin were measured. The study protocol was approved by the Ethical Committee of Afyonkarahisar Health Sciences University (2020/405).

CT protocol

Intravenous contrast enhanced MDCT (Toshiba Aquilion (80x2), Otawara, Japan) was performed. The patients were given iodinated nonionic contrast agent (Omnipaque, Daiichi Pharmaceutical Co., Tokyo, Japan) with an iodine concentration of 300 mg/mL with mechanical injection at a flow rate of 3 mL. Patients were given 1-2 ml/kg iodinated nonionic contrast agent. CT images were obtained during patient breath holding. Contrast enhanced MDCT images had following parameters; slice thickness 2 mm, reconstruction index 1 mm, tube voltage 120 kVp, pitch 0,75. Slices were extended from diaphragmatic dome to the end of pelvis. Coronal and sagittal multiplanar reconstruction (MPR) images were obtained. MDCT images were evaluated by 12-years and 15-years experienced radiologists.

Results

8 (0.054%) patients had spontaneous isolated renal artery dissection (5 M, 3 F). Age range of patients were between 43 and 61 years (average 52). All the patients were admitted to the hospital with the sudden onset of lower quadrant abdominal or flank pain. The patients had no fever. Physical examinations were unremarkable in 7 patients. Only 1 patient had costovertebral angle tenderness and rebound in the left lower quadrant. Laboratory data revealed blood urea and creatinine were normal in all patients. There was no prior history of hypertension, fibromuscular dysplasia, atherosclerosis, vasculitis or clotting disorders. In addition, evaluation for thrombotic diathesis was negative.

MDCT images revealed isolated renal artery dissection without aortic involvement in all patients. The mean distance of dissection from renal artery origin was 3.7 cm (1-4.4 cm) and the average extension was 3.8 cm (2.5-5 cm). Five of the dissections were detected in the right renal artery and 3 in the left renal artery. Three patients had kidney infarct with a focal area of decreased perfusion (Figure 1, Figure 2).

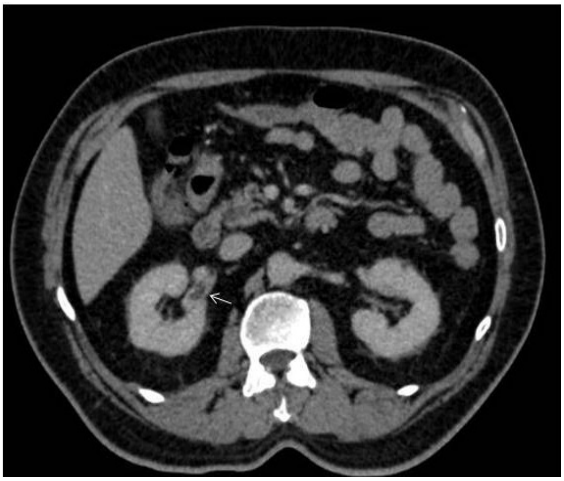
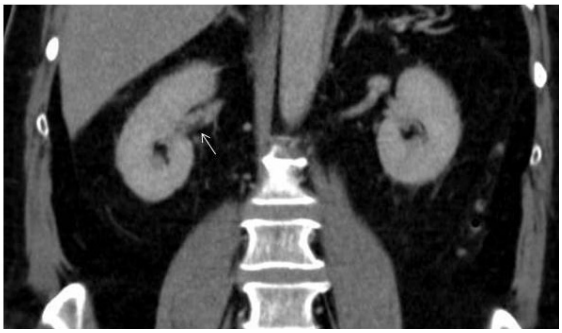


Figure 1. A 57-year-old male patient. Contrast enhanced axial **(a)** and coronal MPR



(b) MDCT images show dissection of right renal artery (arrow). There is no parenchymal infarct. Follow-up CT image performed after treatment

(c) Demonstrates normal right renal artery without evidence of dissection

All the patients started on an anticoagulation therapy (Enoxaparin 40 mg subcutaneously, once a day). Symptoms resolved in 7 patients 2-4 days after beginning therapy. No surgical or endovascular interventional therapy was deemed necessary because all of the 7 patients responded well to the medical treatment.

Only 1 patient who had persistent left lower quadrant rebound underwent DSA after MDCT scan because the symptoms did not decrease with the medical treatment. DSA was performed with femoral catheterization by using digital subtraction technique. Aortograms were obtained, followed by selective catheterization of the renal arteries. Images were then obtained in anteroposterior, lateral, and bilateral oblique projections (+ 45º and - 45º) for each catheterization. DSA images showed the dissection of upper polar branch of left renal artery like MDCT findings. It was observed that the dissection did not cause severe obstruction or stenosis and did not prevent flow. Therefore, no interventional therapy was made, it was decided to continue medical treatment. Follow-up MDCT scan noted normal renal artery without evidence of dissection (Figure 3).

Figure 2. A 48-year-old female patient. Contrast enhanced axial **(a, b, c, d)** and sagittal MPR

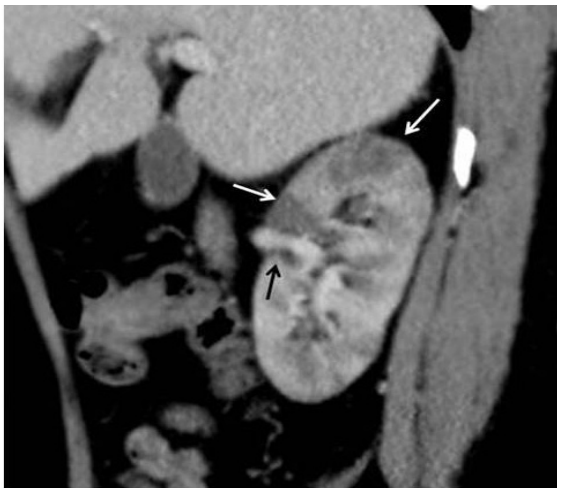


Figure 2. (e) MDCT images reveal partial thrombosed isolated dissection of right renal artery (white arrows). Also focal parenchymal infarctions of right upper pole kidney is noted (black arrows). Follow-up CT image performed after treatment

Figure 2. (f) demonstrates normal right renal artery without evidence of dissection

Figure 3. A 43-year-old male patient
Contrast enhanced axial MDCT **(a, b)** images demonstrate partial thrombosed dissection of the upper polar branch of left renal artery (white arrows). A left kidney infarct with a focal area of decreased perfusion at the superolateral aspect (black arrows) is also seen. Dissection is seen in DSA image

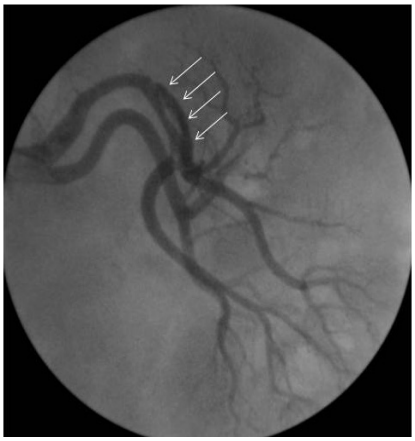


Figure 3. (c) without evidence of severe stenosis (white arrows). Follow-up CT images performed after treatment

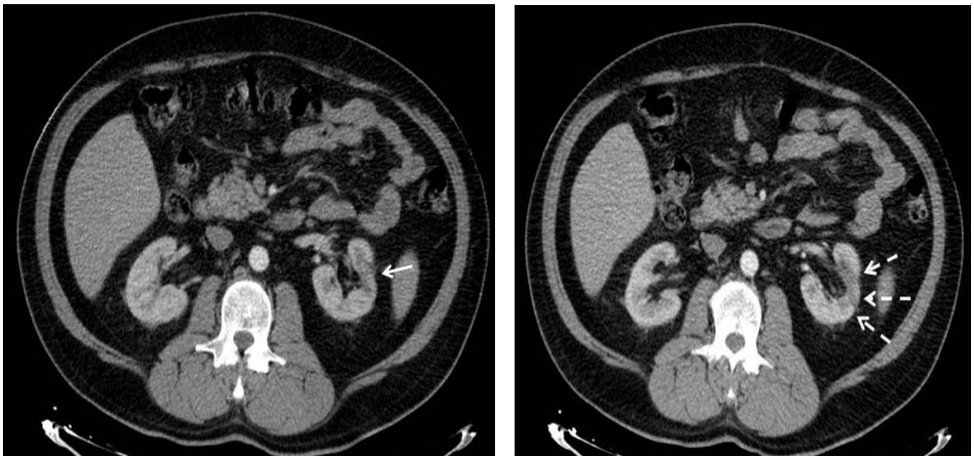


Figure 3. (d, e) noted normal left renal artery without evidence of dissection. There was a minimal hypodens wedge-shaped area with minimal cortical shrinkage in the mid-portion suitable with acute parencymal infarct sequela loss (white arrows)

Since the study was retrospective, 2 patients did not have a follow-up CT. Dissections completely disappeared in other 6 patients.

Discussion

SIRAD is a very rare condition with incidence of 0.036 to 0.049% of all arterial dissections. Renal artery dissections are generally seen with aortic dissections and in 12.4% of all aortic dissections [1]. It is frequently seen in males (male: female ratio 4:1) in their 40s-60s [2]. It is usually unilateral, but also bilateral lesions are noted in 10–15% of cases [3].

There are different classifications of renal artery dissections. They are divided into two types according to dissection's location as isolated (only seen in renal artery without aortic involvement) and combined (originating from aorta and involves renal artery). According to underlying reason, they are classified as primary (associated with hypertension or fibromuscular dysplasia); secondary or iatrogenic (associated with trauma or endovascular catheterization); idiopathic (without known underlying pathology); agonal (associated with systemic diseases such as sepsis, malignancy, cirrhosis). Spontaneous isolated renal artery dissections are seen in otherwise healthy people with acute onset. [2, 3]. SIRAD may be a primary condition, or found as an idiopathic or an, isolated situation and may as well be seen in healthy people too.

The etiology of SIRAD is not well known. Some associated conditions include severe atherosclerosis, fibromuscular dysplasia, malignant hypertension, Marfan's syndrome or Ehlers-Danlos syndrome [4]. Changes or local breakdown in intima media of the artery and rupture of vaso vasorum may be the etiologic factors [5].

The initial symptoms are generally nonspecific such as severe upper abdomen or flank pain, hematuria. In our study, all patients were admitted to hospital with nonspecific complaints such as the sudden onset of lower quadrant abdominal or flank pain. This nonspecific presentation often leads delayed diagnose. There are three clinical sequalae of renal artery dissection according to literature; 1) silent with no side effects, 2) renal infarction due to acute renal artery occlusion; 3) chronic, leading to renovascular hypertension [1]. New-onset, uncontrolled hypertension, renal failure resulting from diminished or absent blood flow and infarction of the renal parenchyma are some important complications of renal artery dissection. It may also lead to renovascular hypertension probably due to hypoperfusion and activation of the renin-angiotensin aldosterone system [3]. Early diagnosis is important to prevent complications or unnecessary treatments.

Because this condition is rare and the symptoms are vague, the diagnosis is often not considered until additional imaging studies such as contrast enhanced CT or CTA are performed. Renal ultrasound and Doppler examination are not sensitive enough to make the diagnosis. DSA is still the gold standard for diagnosis and also provides vascular intervention [1].

Once diagnosed, management can be conservative interventional, or surgical. Non-surgical conservative managements include controlling blood pressure and pain, giving angiotensin converting enzyme inhibitors, long-term anticoagulation with coumadin [6, 7]. Conservative management with or without anticoagulation has been used with good results [4]. Treatment with antiplatelet and antihypertensives therapy and followed up by CT angiography also showed good results being beneficial in 77% of patients in another small series of eight patients followed up for 72 months [7]. In our study; all the patients started on an anticoagulation therapy and symptoms resolved in 87.5% of patients 2-4 days after beginning therapy. Failure of conservative management may lead to complications of either acute infarction or chronic renovascular hypertension due to decreased renal perfusion.

Indications of surgical treatment are acute occlusion or refractory renovascular hypertension in the chronic stage [7]. Most common surgical approach is aortorenal bypass. Müller at al. [8] treated 25 patients surgically and the failure rate was 20%. In another study van Rooden et al. [9] treated 15 patients with extracorporeal reconstruction and autotransplantation, a success rate of 95% was reported with 80% patients having good control of blood pressure. Vascular reconstruction has been associated with late anastomotic stenosis and high rates of acute thrombosis [7, 10].

Percutaneous endovascular intervention is another choice for patients whose condition is refractory to medical management. Compared with surgical and conservative treatment, it has been shown to lead less use of antihypertensive medications, less complication rates and less target organ damage with long-term follow up [10]. Percutaneous coil embolization has been reported in a case of SIRAD in an accessory renal artery [11]. In our study, DSA was applied to only 1 patient because his complaints continued despite medical treatment. DSA showed that the dissection did not cause severe obstruction or stenosis and did not prevent flow. Therefore, no interventional therapy was made, it was decided to continue medical treatment.

The limitations of our study are its retrospective nature and consequently the absence of follow-up CT images in 2 patients.

In conclusion; SIRAD is a rare but important entity that may cause renal parenchymal infarcts and affect renal functions. It can be difficult to diagnose it early due to nonspecific symptoms. Early diagnosis is important for preventing unnecessary medications or surgeries and renal disfunctions. It should be considered in patients with new-on-set flank or abdominal pain, particularly when renal function is affected.

Conflict of interest: No conflict of interest was declared by the authors.

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Ethics approval: The study was approved by the Afyonkarahisar University Ethical Committee (date: 11/09/2020, number: 2020/405).

Contributions of authors

E.Ö. constructed the main idea and hypothesis of the study. F.K. developed the theory and edited the material method section. E.Ö. reviewed the literature, wrote and drafted the initial manuscript. F.K. reviewed and made the necessary corrections and approved. All authors approved the final manuscript as submitted and agree to be accountable for all aspects of the work.