

# Prevalence of Accessory Renal Artery In Aortic Aneurysms

## Aort Anevrizmalarında Aksesuar Renal Arter Sıklığı

Mustafa Etli<sup>1\*</sup>, Seda Avnioğlu<sup>2</sup>, Rumeysa Dikici<sup>2</sup>

<sup>1</sup>Alanya Alaaddin Keykubat University Faculty of Medicine, Department of Cardiovascular Surgery, Antalya, Turkey

<sup>2</sup>Alanya Alaaddin Keykubat University Faculty of Medicine, Department of Anatomy, Antalya, Turkey

### ABSTRACT

**Introduction:** Open surgical procedures and endovascular aortic procedures are the most feared renal injuries in abdominal aortic surgery. The presence of renal anomalies and clear localization during aneurysm repair brings surgical success. In this article, we aimed to show the importance of renal anomalies in terms of mortality and morbidity in aneurysm repair.

**Materials and Methods:** Between January 2017 and January 2019, 250 patients with aortic aneurysm and CT angiography were included in the study. The files of the patients who underwent computerized contrast angiography for aortic aneurysm in Training and Research Hospital were reviewed retrospectively.

**Results:** Bilateral renal artery was detected in four male patients; and left accessory renal artery was detected in five male and three female patients. At the end of the study, 250 patients were screened; and bilateral renal arteries were detected in 1.6%, left accessory arteries were detected in 3.2% of the eight patients.

**Conclusions:** It is important that surgeons and radiologists know the accessory arterial variations not only in abdominal aortic surgery, but also in recent years due to increased renal transplantation reconstruction, urological and radiological surgical techniques.

**Key Words:** Renal Artery Anomaly, Abdominal Aortic Aneurysm, EVAR, Renal insufficiency

### ÖZET

**Amaç:** Abdominal aort cerrahisinde açık cerrahi işlemler ve endovasküler aort girişimlerde en çok korkulan renal hasarlar olmasıdır. Anevrizma tamiri esnasında renal anomalilerin varlığı ve lokalizasyonu net olarak bilinmesi cerrahi başarıyı beraberinde getirir. Bu makalede renal anomalilerin anevrizma tamirinde mortalite ve morbitide açısından önemini göstermeyi amaçladık.

**Gereç ve Yöntem:** Eğitim Araştırma Hastanemizde aort anevrizması nedeniyle bilgisayarlı kontrastlı anjiyografi uygulanan hastaların dosyaları retrospektif olarak incelenmiştir. Ocak 2017- Ocak 2019 tarihleri arasında elde edilmiş, 250 Aort Anevrizma tanısı olan ve BT anjiyografi çekilen hastalar çalışmaya dahil edilmiştir.

**Bulgular:** Dört erkek hastada bilateral çift renal arter, beş erkek ve üç kadın hastada ise sol aksesuar renal arter tespit edilmiştir. Çalışmanın sonunda 250 hastalık taramada bilateral renal arter %1,6 ve sekiz hastada sol aksesuar arter %3,2 oranında hasta bulundu.

**Sonuç:** Aksesuar arter varyasyonlarının, sadece abdominal aort cerrahisinde değil, son yıllarda artan renal transplantasyon rekonstrüksiyon, ürolojik ve radyolojik cerrahi teknikler sebebiyle cerrahlar ve radyologlar tarafından iyi bilinmesi önem arz etmektedir.

**Anahtar Kelimeler:** Renal Arter Anomalisi, Abdominal Aort Anevrizması, EVAR, Renal yetmezlik

### Introduction

The kidneys reach their adulthood position embryologically at the ninth week; and as the kidneys take the adult position, the blood supply is provided by the branches that originate from the cranial end of the aorta abdominalis and the initial branches degenerate (1, 2).

Renal arteries originate from the abdominal aorta at the level of the intervertebral disc between the first and second lumbar vertebrae. These vessels

are generally at the level of L1 and L2 vertebrae, upper mesenteric artery just below the onset. Left renal artery is usually slightly higher than the right. Right renal artery is longer and passes under the vena cava inferior (3).

Each renal artery enters the hilum and is divided into anterior and posterior branches that feed the kidney parenchyma, then they are typically divided into four or more segmental branches (4). The accessory renal arteries, called the extrahedral artery, originate from the lateral side of the aorta,

\*Sorumlu Yazar: Mustafa Etli, Dept. of Cardiovascular Surgery, Alanya Alaaddin Keykubat University Faculty of Medicine, Antalya, Turkey  
E-mail: mustafa.etli@alanya.edu.tr, Phone: +90 (533) 438 19 10

ORCID ID: Mustafa Etli: 0000-0001-9320-3971, Seda Avnioğlu: 0000-0003-1719-4190, Rumeysa Dikici: 0000-0003-3144-8740

Geliş Tarihi: 06.02.2020, Kabul Tarihi: 07.05.2020



**Fig. 1A.** Double renal artery image on CT scan of aneurysm patient



**Fig. 1B.** 3-D dual renal artery image of aneurysm patient

the top or bottom of the main renal arteries with the main renal arteries entering the kidney directly from the hilum or at various levels (3). It is clinically important that the accessory renal arteries do not anastomose with the branches of the main renal artery (5).

First description of accessory renal arteries was given in 1564 by Eustachi, and since then renal artery terminology has been controversial and unclear (6).

Abdominal aortic aneurysm (AAA) is defined as an abdominal aortic diameter of 3 cm or more at the infrarenal level. The incidence increases with age and 5% over 65 years; and it is seen with a prevalence of 9% above 75 years of age. It ranks 13<sup>th</sup> among all causes of death in studies conducted in the United States. AAA is the most common true aneurysm. The low medial elastin layer in the infrarenal region is a predisposing factor for aneurysm formation in this region. Risk factors for Familial Mediterranean Fever (FMF) development are age, male sex, smoking, hypertension, atherosclerotic cardiovascular disease; and dyslipidemia is a weak risk factor. There is also a familial incidence (7, 8).

Aneurysm diameter is very important in the management of abdominal aortic aneurysms. Aneurysms with a diameter of 4 cm or less have a



**Fig. 2.** CT image of a patient with renal artery variation treated with EVAR (Aneurysm diameter was 57 mm.)

low chance of rupture (less than 1% per year) and should be followed. Despite the fact that the ruptured AAA has been around 50 years since the first successful surgical repair and considerable improvements have been made in surgical, anesthesia and intensive care conditions, it still causes high rates of mortality and morbidity, so it is of great importance (9). Aneurysms with an aneurysm diameter of 4-5.5 cm are controversial. UKSAT and ADAM studies suggested that aneurysm diameter should be waited until 5.5 cm, while aneurysm diameter increased rapidly (1 cm or more per year). Both studies were actually performed considering open surgical method. On the other hand, similar results were obtained in CEASAR and PIVOTAL studies with the introduction of endovascular method, and follow-up of aneurysms with a diameter of 4-5.5 cm was recommended. For aneurysms with a diameter of 5.5 cm or more, intervention is required when diagnosed. It should be noted that the higher the diameter of the aneurysm, the higher the chance of rupture (10-15).

Although abdominal aortic aneurysms are mostly located in the infrarenal region, renal artery and veins are very important because they extend in the suprarenal region. In recent years, many conservative surgical methods related to renal artery have emerged. Therefore, the exact course of renal artery has become a necessity. It is important to know the presence of accessory renal arteries; otherwise, they may be damaged during kidney surgery. In addition, the presence of additional arteries should be considered when evaluating a donor's kidney for a possible kidney transplant (16). This is important for the possibility of the presence of accessory renal artery extending to the suprarenal region in the operations performed for abdominal aortic aneurysms. In our study, we aimed to evaluate the renal artery variations in patients with aortic aneurysm and to provide an idea of how these can be reflected in the clinic.

## Materials and Methods

In this study, files of patients who underwent computerized contrast angiography for aortic aneurysm in Training and Research Hospital were retrospectively analyzed. Between January 2017 and January 2019, 250 patients with aortic aneurysm and CT angiography were included in the study. Bilateral renal artery was detected in four male patients and left accessory renal artery was detected in five male and three female patients (Table 1) (Figure 1a-1b) (Figure 2). This study was approved by the local ethics committee of scientific researches of Faculty of Medicine (2019/10/5).

## Results

In the study; A retrospective review of patients with aortic aneurysm and contrast-enhanced tomography was conducted. At the end of the study, 250 patients were screened in 1.6% of bilateral renal arteries and 3.2% of left accessory arteries in eight patients. According to the literature, the reason for the low incidence of variation in a.renalis are the retrospective screening of the patients with aortic aneurysms and the fact that the patient group is in the 45-85 age range; therefore, not covering the whole population.

## Discussion

The frequency of extra renal arteries (ERA) shows variability from 9% to 76%; and is generally between 28%-30% in anatomic and cadaver studies (1).

In a study by Ozkan et al., 76% of 855 patients had single a.renalis, and 24% had more than one a.renalis. The presence of one single a.renalis was detected in 713 (83%) cases in the right kidney, and two a.renalis were detected in 126 (15%) cases, three a.renalis were detected in 9 (1%) cases. One a.renalis was reported in the left kidney in 736 (86%) cases, two in 105 (12%) cases, three in 6 (0.7%) cases, and four in 2 (0.2%) cases. In 46 (5%) cases, more than one a. renalis was reported (1).

Gumus et al. performed an MDCT angiography examination with 820 people, and found a 27% extrarenal artery. Renal artery variation is seen in approximately one quarter of this study population (17).

In the study performed by Cicekcibasi et al. on 90 fetuses, 75% had a single a.renalis, 11.1% had double a.renalis, 10.5% had lower pole artery, and 3.3% had upper pole artery. Anatomical variations have been reported more frequently in male fetuses and on the right side (18).

Unilateral double renal vessels were reported by Mohammed in 2012 (16). Bilateral duplication of renal vessels was reported by Bordei et al. (17) in 2004 and by Mir et al. (18) in 2008. The same was also observed in the present study. Bilateral triple renal arteries were observed by Pestemalci et al. (4) in 2009.

When renal artery variations are clinically evaluated; knowing the anatomical variations of renal vessels is important in the surgical treatment of conditions such as kidney transplantation, congenital or subsequent vascular lesions and abdominal aortic aneurysm. It is also of special importance, since the morphology of the renal veins in the kidney transplant will greatly affect the technical aspect of the surgery (19, 20).

Ersoz et al. stated that; more than one renal artery is a disadvantage in kidney transplantation (21). Yalın et al. reported that the renal arteries are "end arteries", and when they are attached, necrosis, ulceration and fistulas may occur in the kidney tissue they feed (22).

In addition, it is stated in the literature that extra renal arteries may cause dilatation and hydronephrosis over time due to their pressure on their neighborhood (23).

Precise knowledge of the most frequent types of renal vascular anatomical variations is needed due to the continuous growing and development of surgical procedures such as renal transplants, aneurysms repair, oncologic partial nephrectomy, ablation treatment for refractory hypertension and vascular reconstructions (6, 24).

As a result, it will help surgeons to know the renal artery variations in patients with abdominal aortic aneurysms and compare the incidence compared to the normal population, especially during abdominal surgical approaches and radiological examinations.

Considering the increasing number of malpractice cases and the resulting defensive surgery in recent years, even a patient is of great importance. Since abdominal surgery is the most feared renal injury in open surgical procedures and endovascular aortic procedures, renal arteries are of great importance in both surgical procedures. The position of renal arteries during aneurysm repair is very important. The surgical margin is determined

**Table 1.** Demographic characteristics of patients with accessory renal artery in aortic aneurysms

Gender	Age	Aortic Diameter	Diabetes	Smoking	Hypertension	Left Accessory Renal Artery	Bilateral Renal Artery
Male	63	57	-	+	+	-	+
Male	45	48	-	+	-	-	+
Male	43	45	-	+	-	-	+
Male	55	51	-	-	+	-	+
Male	43	50	-	-	-	+	-
Male	63	52	-	+	-	+	-
Male	66	48	+	+	-	+	-
Male	72	53	-	-	+	+	-
Male	68	46	-	-	-	+	-
Female	49	45	+	-	+	+	-
Female	70	50	-	-	-	+	-
Female	54	47	-	-	+	+	-

according to the position of the right and left renal artery. However, while the position of the renal artery is very important in surgery, it is not considered that it may be an accessory renal artery and perhaps postoperative renal dysfunction may result from an accessory renal artery being closed during the operation.

In addition, it is important to know the accessory artery variations by radiologists and surgeons not only in abdominal aortic surgery but also in recent years due to increasing renal transplantation reconstruction, urological and radiological surgical techniques.

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