

Double Left Renal Vein Encircling the Aorta (Renal Collar)

Pelin İsmailoğlu¹ , Ercan Tanyeli² , Mehmet Üzel² , Ali İhsan Soyloğlu² , Güler Kahraman Yıldırım² 

¹Department of Anatomy, Acıbadem Mehmet Ali Aydınlar University School of Medicine, İstanbul, Turkey

²Department of Anatomy, İstanbul University-Cerrahpaşa, Cerrahpaşa School of Medicine, İstanbul, Turkey

Cite this article as: İsmailoğlu P, Tanyeli E, Üzel M, Soyloğlu Aİ, Kahraman Yıldırım G. Double Left Renal Vein Encircling the Aorta (Renal Collar). *Cerrahpaşa Medical Journal* 2020; 44(2): 112-114.

Abstract

A double left renal vein is a rare venous anomaly. During our routine gross anatomy course dissections, we found a double left renal vein encircling the aorta (renal collar) in a 72-year-old male cadaver. In our case, both these veins were draining into the inferior vena cava at different levels. The left suprarenal vein was draining into the anterior vein, and the left testicular vein was draining into the posterior vein. We searched the literature and discussed the clinical importance of this variation.

Keywords: Renal vein, variation, suprarenal vein, circum-aortic

Aortu Çevreleyen Çift Sol Renal Ven Olgusu

Öz

Çift sol renal ven nadir görülen bir venöz anomalidir. Rutin anatomi diseksiyonları sırasında 72 yaşında bir erkek kadavrada aortu çevreleyen çift sol renal ven bulundu. Sol tarafta bu şekilde çift olan renal venin aorta abdominalis'i ön yüzden ve arka yüzden sardığı ve sonrasında vena cava inferior'a drene olduğu gözlemlendi. Olgudaki bu damarların her ikisinin de farklı düzeylerde inferior vena cava içerisine drene olduğu farkedilip buradan uzunluk ve genişlik ölçümü yapıldı. Aorta abdominalis'i ön yüzden ve arka yüzden çevreleyen renal venlerden öndekine sol vena suprarenalis; arkadakine ise sol vena testicularis'in drene olduğu tespit edildi. Olguda bulunan bu varyasyonun klinik önemi araştırıldı ve literatürdeki diğer araştırmalar ile kıyaslama yapıldı.

Anahtar Kelimeler: Renal ven, varyasyon, suprarenal ven, circum-aortik

The renal veins lie anterior to the renal arteries. The left renal vein runs behind the body of the pancreas and above the horizontal part of the duodenum. It opens into the inferior vena cava at right angles. The left renal vein is three times longer than the right one. It is anterior to the aorta, just below the origin of the superior mesenteric artery, and it receives the left suprarenal, the left inferior phrenic, and the left gonadal veins [1].

During the fifth and seventh weeks of the embryological development, the paired subcardinal and supracardinal veins appear around the aorta. The supracardinal veins lie posterior to the aorta, and the subcardinal veins lie anterior to the aorta. The two subcardinal veins are connected by intersubcardinal anastomosis, which lies anterior to the aorta, and the supracardinal veins are connected by the intersupracardinal anastomosis, which lies posterior to the aorta. There are also

sub-supracardinal anastomoses on each side between the corresponding veins. On the right side, the supracardinal and subcardinal veins, and the anastomosis between them, take part in the formation of the inferior vena cava. On the left side, the supracardinal and subcardinal veins persist and the left sub-supracardinal anastomosis receives two primitive renal veins (dorsal and ventral) from the metanephros (primitive kidney). Normally, the dorsal primitive renal vein, the dorsal part of the left sub-supracardinal anastomosis, and the entire intersupracardinal anastomosis regress; thus, the renal vein passes anterior to the aorta in the adult. If the ventral primitive renal vein, the ventral part of the left sub-supracardinal anastomosis, and the entire intersubcardinal anastomosis regress, the renal vein passes posterior to the aorta in the adult (retroaortic renal vein). If all these veins and anastomoses persist, the circum-aortic venous ring (renal collar) is formed [1, 2]. As the number of invasive interventions involving this area increases, the specialists should be familiar and cautious with such kind of variations of this region. Morphological variations of renal vessels should be taken into account in both planning and conducting diagnostic and surgical medical procedures [3].

Received/Geliş Tarihi: 19.11.2019 **Accepted/Kabul Tarihi:** 30.03.2020

Address for Correspondence/Yazışma Adresi: Pelin İsmailoğlu, Department of Anatomy, Acıbadem Mehmet Ali Aydınlar University School of Medicine, İstanbul, Turkey

E-mail/E-posta: pelinismailoglu@yahoo.com

DOI: 10.5152/cjm.2020.19022



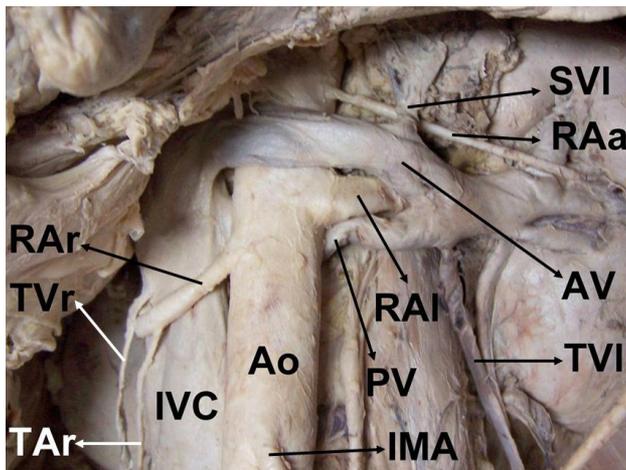


Figure 1. Close view of the renal collar (before the aorta was dissected)

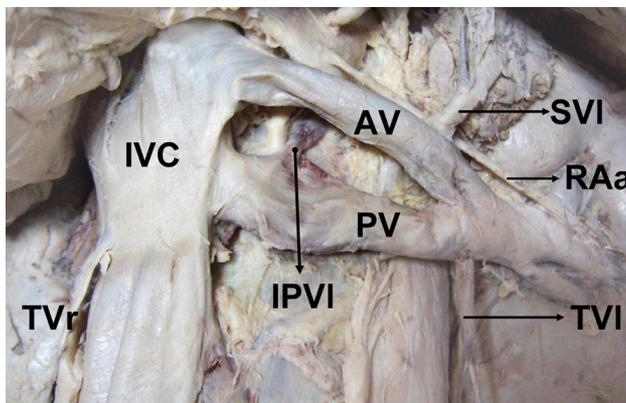


Figure 2. Close view of the renal collar (after the aorta was dissected)

Case Presentation

During our routine gross anatomy course dissections, we found a double left renal vein encircling the aorta (renal collar) in a 72-year-old male cadaver fixed with formalin-glycerol-alcohol mixture. As it is a variation encountered during routine anatomy practices, a patient consent form is not required. We performed the dissection in two steps. First, we dissected the aorta and the inferior vena cava carefully and took photographs (Figure 1). After this, we removed the aorta and obtained a better view of the posterior renal vein and took photographs again (Figure 2). In our case, both veins were draining into the inferior vena cava at different levels. The left suprarenal vein was draining into the anterior vein, whereas the left testicular and the left inferior phrenic veins were draining into the posterior vein (Figure 2). The length of the anterior vein was 6.4 cm, and the length of the posterior vein was 6 cm. The widths of the inferior vena cava, anterior vein, and posterior vein were 2.9 cm, 1.4 cm, and 2.2 cm, respectively. The distance between the openings

of the anterior vein and the opening of diaphragmatic caval was 3.1 cm. The distance between opening of diaphragmatic caval and opening of the posterior vein was 5.9 cm. As additional variations in this cadaver, the right testicular artery was branching from the right renal artery, and there was an additional thin renal hilar artery branching from the aorta between the origins of the superior mesenteric and the left renal arteries (Figure 1). It coursed just above the anterior left renal vein and passed behind the left suprarenal vein.

Discussion

The case reports of renal collar variations are rare in the literature [3, 4]. The renal collar was examined in many studies since 1896, and the percentages ranged between 0.2% and 30%. In 1914, Hovelacque studied only 20 samples and found the ratio of the renal collar in 6 samples [5]. In the literature, no other studies reported such a high percentage since 1914. The median percentage of the renal collar is 5.7% [6]. The studies that were conducted in recent years and in many subjects revealed much smaller percentages according to the older studies' renal vein variations. In their study, Satyapal et al. [6] examined 1008 kidneys to investigate the ratios of renal vein variations. Their samples consisted of cadavers, donor kidneys, retrospective analysis of venograms, and inspections during surgeries involving the area [6]. The overall percentage of the renal collar in their series was 0.3%. Hoeltl et al. [7] conducted a study in 5089 cases (4520 Computed Tomography (CT) scans, 215 operation inspections, and 354 autopsy findings). The percentage of the renal collar in operation inspections, CT scans, and autopsy was 0.9%, 0.08% and 0.5%, respectively. The overall percentage of the renal collar in 5089 cases was 0.2%. Shindo et al. [4] reported 1 case in 166 subjects (0.6%) who underwent aortic surgery.

In retroperitoneal surgery procedures, such as aortic aneurysm repair, lumbar sympathectomy, adrenalectomy, and nephrectomy, the retroaortic renal vein is important. During retroperitoneal surgery, the surgeon may visualize a pre-aortic renal vein but may be unaware of an additional retroaortic component or posterior primary tributary and may tear it while mobilizing the kidney or clamping the aorta [6]. Toda et al. [8] reported such a complication during an abdominal aortic aneurysm surgery. Furthermore, the renal collar can restrict the availability of the left renal vein in mobilization procedures, such as splenorenal shunt [6]. Because of the rising frequency of laparoscopic techniques in nephrectomy, this variation has gained more importance.

Accompanied vascular variations with renal collar vein have also existed. In our study, the suprarenal

vein was draining into the anterior segment of the circumaortic left renal vein. As the suprarenal vein always drains into the anterior segment of the circumaortic renal collar, this segment should be chosen if blood samples are to be taken for suprarenal hormonal assays (6). It is one of the similarities in our study with the cases done by Haladaj et al. [3] in 2019. It is detected in both our study and Haladaj et al. [3] study is that the left gonadal vein drains into the posterior segment of the circumaortic left renal vein. In addition to these variations, left inferior phrenic vein (IPVI) draining to the posterior segment of the renal collar vein was observed after aortic removal in our dissection (Figure 2). Besides the variations of veins there were some arterial variations in the left and right sides in our case. Firstly, an additional hilar artery originates from aorta on the left side (RAa) has been observed. Haladaj et al. [3] has also found an additional hilar artery on the left. Secondly, on the right side testicular artery originates from renal artery has also been detected in our case. Moreover, since the left renal vein is three times longer than the right, the frequent selection of the left side in renal transplantation depicts that it is important to know the left side variations in detail [3].

Because of the potential risks of a renal collar, it is necessary to examine its existence prior to any intervention at the region. To examine the venous pattern before surgery, imaging techniques should be applied. However, unfortunately, imaging techniques do not show all variations compared to operation, dissection, and autopsy studies [9]. The percentages of the renal collar in radiologic studies are less than those in the dissection and operation studies [4, 6, 7]. The anterior and posterior veins can superimpose on each other in venographies. In CT or Magnetic Resonance Imaging (MRI), the posterior vein could be misinterpreted or not recognized at all. So, even if no variation is found by imaging techniques, surgeons should keep the possibility of the renal collar in their mind during surgery to exclude any risk of damaging the posterior vein.

Informed Consent: As it is a variation encountered during routine anatomy practices, a patient consent form is not required.

Peer-review: Externally peer-reviewed.

Author Contributions: Concept - E.T.; Design - P.İ.; Supervision - G.K.; Resources - M.U.; Materials - M.U.; Data Collection and/or Processing - E.T.; Analysis and/or Interpretation - A.İ.S.; Literature Search - P.İ.; Writing Manuscript - P.İ.; Critical Review - E.T.

Acknowledgment: We would like to thank Cerrahpaşa Anatomy department staff for providing a research environment.

Conflict of Interest: The authors have no conflicts of interest to declare.

Financial Disclosure: The authors declared that this study has received no financial support.

Hasta Onamı: Çalışma, rutin anatomi uygulamaları sırasında karşılaşılan bir varyasyon olduğundan, hasta onam formu alınmamıştır.

Hakem Değerlendirmesi: Dış bağımsız.

Yazar Katkıları: Fikir - E.T.; Tasarım - P.İ.; Denetleme - G.K.Y.; Kaynaklar - M.U.; Malzemeler - M.U.; Veri Toplanması ve/veya İşlenmesi - E.T.; Analiz ve/veya Yorum - A.İ.S.; Literatür Taraması - P.İ.; Yazıyı Yazan - P.İ.; Eleştirel İnceleme - E.T.

Teşekkür: Cerrahpaşa Anatomi bölümü personeline araştırma ortamı sağladığı için teşekkür ederiz.

Çıkar Çatışması: Yazarlar çıkar çatışması bildirmemişlerdir.

Finansal Destek: Yazarlar bu çalışma için finansal destek almadıklarını beyan etmişlerdir.

References

1. Standing S, Ellis H, Healy JC, Johnson D WA. Collins P. Gray's Anatomy, 39th edn Elsevier Churchill Livingstone. 2005; 1049.
2. Macchi V, Parenti A, De Caro R. Pivotal role of the sub-supracardinal anastomosis in the development and course of the left renal vein. Clin Anat 2003; 16: 358-61. [\[Crossref\]](#)
3. Haladaj R, Polguy M, Wysiadeci G, Żytowski A, Topol M. Circumaortic left renal vein (circumaortic renal collar) associated with the presence of vascular anomalies: a case series and review of literature. Folia Morphol 2019; 78: 437-43. [\[Crossref\]](#)
4. Shindo S, Kubota K, Kojima A, Iyori K, Ishimoto T, Kobayashi M, et al. Anomalies of inferior vena cava and left renal vein: risks in aortic surgery. Ann Vasc Surg 2000; 14: 393-6. [\[Crossref\]](#)
5. Hovelacque A. Note sur les origines de la veine grande azygos et de l'heime inférieure et sur leurs rapports avec le diaphragm. Bibliogr Anat 1914; 24: 204-10.
6. Satyapal KS, Kalideen JM, Haffjee AA, Singh B, Robbs JV. Left renal vein variations. Surg Radiol Anat 1999; 21: 77-81. [\[Crossref\]](#)
7. Hoeltl W, Hruby W, Aharinejad S. Renal vein anatomy and its implications for retroperitoneal surgery. J Urol 1990; 143: 1108-14. [\[Crossref\]](#)
8. Toda R, Iguro Y, Moriyama Y, Hisashi Y, Masuda H, Sakata R. Double left renal vein associated with abdominal aortic aneurysm. Ann Thorac Cardiovasc Surg 2001; 7: 113-5.
9. Rathod K. Images in Radiology Circumaortic renal collar Circumaortic renal collar Circumaortic renal collar A. Vol. 50, J Postgrad Med 2004.