

Co-existence of circumaortic renal collar, accessory renal artery and anomalous arrangement of hilar structures in the same cadaver: A case report

Thejodhar.P¹, B. Kumar.Potu¹, M.S. Rao¹, S. Madhyastha², V. Rakesh.G¹, V. Ramana³, B. Ray¹, V. Kumar⁴, D. Pereira⁵ and P. Kumar.A⁶

1- Department of Anatomy, Kasturba Medical College, Manipal, Karnataka, India

2- Department of Anatomy, Kasturba Medical College, Mangalore, Karnataka, India

3- Department of Anatomy, Melaka Manipal Medical College, Manipal, Karnataka, India

4- Department of Anatomy, Kunhitharuvai Memorial Charitable Trust Medical College, Calicut, Kerala, India

5- Department of Physiotherapy, College of Allied Health Sciences, Manipal, Karnataka, India

6- Department of Surgery, Kasturba Medical College, Manipal, Karnataka, India

SUMMARY

Multiple variations in the blood vessels of the kidney were observed during routine dissection of the retroperitoneal region of an elderly male cadaver. A variant drainage pattern of the venous blood from the left kidney was found. It was drained by two renal veins. At the hilum, one was lying in front of the ureter and the other behind. These two were joined by a communicating channel. The anterior vein crossed the aorta, running superficial to it and drained into the IVC but the posterior vein followed a retro-aortic course and drained into the IVC. Thus, the 2 veins formed a circumaortic collar. We also report an accessory renal artery and the anomalous arrangement of hilar structures on the left side. The arrangement of the hilar structures from anterior to posterior was accessory renal artery, anterior renal vein, left renal artery, ureter and the posterior renal vein. Thus, the normal arrangement of renal vein, renal artery and renal pelvis was not seen on the left side. However, all the structures were normal on the right side.

Key words: Circumaortic renal collar – Accessory renal artery – Variant – Left renal vein

INTRODUCTION

Knowledge of the variations of renal vascular anatomy is important in the exploration and treatment of renal trauma, renal transplantation, renovascular hypertension, renal artery embolization, angioplasty or vascular reconstruction for congenital and acquired lesions, surgery for abdominal aortic aneurysm and conservative or radical renal surgery (Sampaio and Aragao, 1990; Satyapal et al., 1999; Senecail et al., 2003). Anatomical variations and congenital anomalies of the renal veins have been well described (Gillot, 1978 and Bergman et al., 1988). These anomalies in the renal veins show less variation than the renal arteries, and the right renal vein may be doubled, even though the left renal vein is usually single (Testut and Latarjet, 1947; Bergman et al., 1988). Among the numerous variations of this vein, the retro-aortic course is much

less well known (Bergman et al., 1988; Satyapal et al., 1999; Senecail et al., 2003).

The circumaortic renal collar is a potentially hazardous anomaly of the left renal vein. Failure to recognize the dorsal component during retroperitoneal surgery may lead to hemorrhage, nephrectomy or death. Thus, it seemed to us of value to present a case discovered during dissection of the retroperitoneal organs.

The accessory renal arteries and the anomalous arrangement of hilar structures are the most common renal vascular variant. They can be demonstrated in up to a third of patients (Pollak et al., 1986; Urban et al., 2001).

CASE REPORT

In routine dissection of 47 year old male cadaver we observed the following variations. The left kidney was drained by 2 renal veins. At the hilum, one was lying in front of the ureter and the other behind it. There was also

a small communicating channel between the 2 renal veins. The anterior vein crossed the aorta, running superficial to it, and drained into the IVC but the posterior vein was running behind the aorta and also drained into the IVC. Thus, the 2 veins formed a circumaortic collar (see Fig. 1).

In the same cadaver, the left renal artery arose about 1cm inferior to the right renal artery and its course was almost horizontal for about 0.5 cm, after which it bifurcated into an upper and a lower branch. The upper branch ran obliquely upwards to the upper pole and the lower one to the hilum of the kidney, posterior to the left renal vein. There was an additional branch from the aorta, arising in line with the right renal arteries and ran obliquely downwards and to the left to reach the lower part of the hilum. Before reaching that area it bifurcated. It was anterior to the renal vein at the hilum. All other vessels, organs, and systems of the cadaver were normal in every aspect.

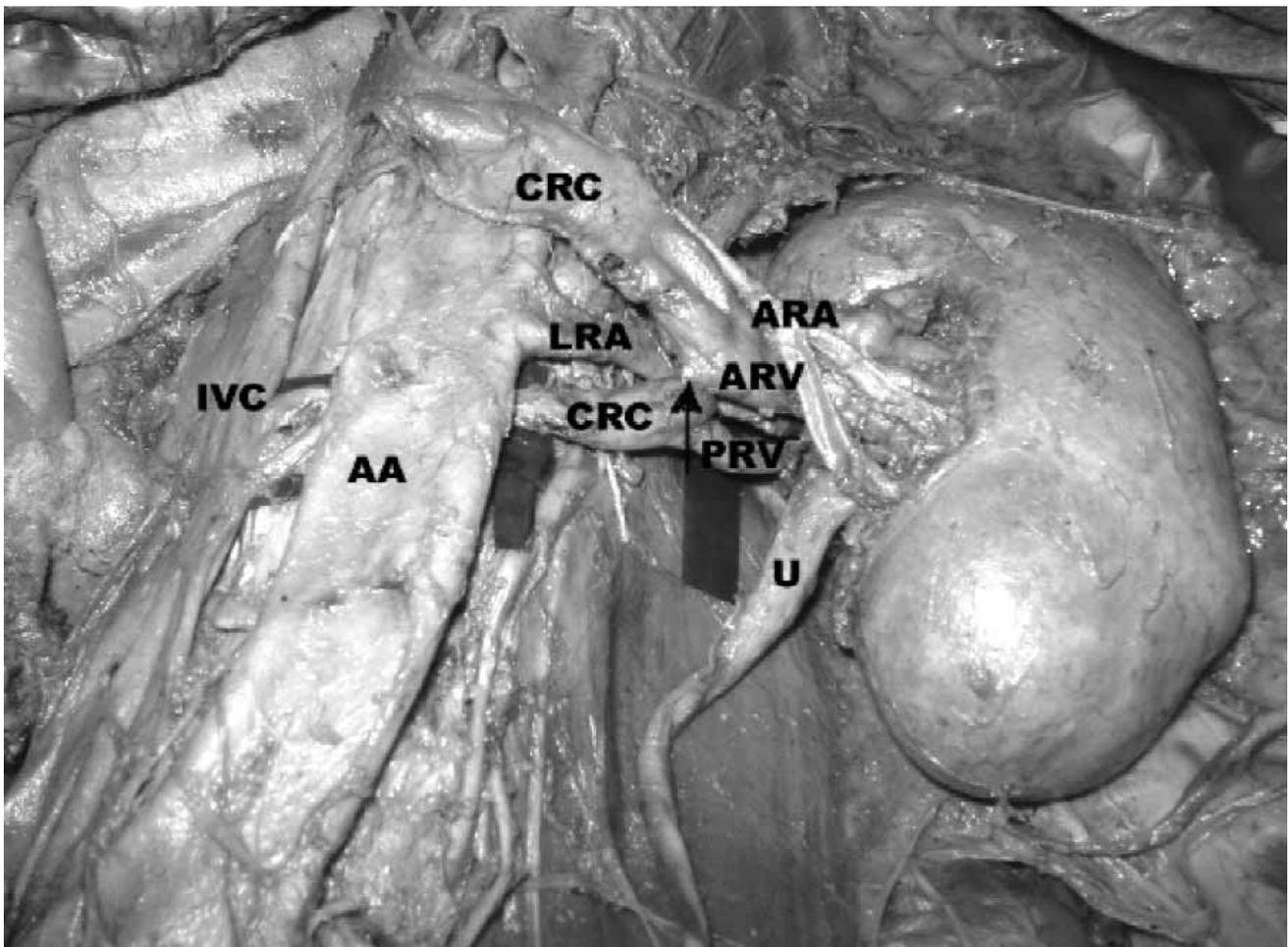


Fig 1. The left lumbar region with a circumaortic renal collar, accessory renal artery and anomalous arrangement of hilar structures; CRC: Circumaortic renal collar; AA: Abdominal aorta; IVC: Inferior vena cava; LRA: Left renal artery; ARA: Accessory renal artery; ARV: Anterior left renal vein; PRV: Posterior left renal vein; U: Ureter. The arrow indicates the communicating channel between anterior left renal vein and posterior left renal vein.

DISCUSSION

To the best of our knowledge a combination of the above variations in a single cadaver is unique and has not been reported previously. The existence of a circumaortic renal collar is a rare anomaly involving the left renal vein, which has two components, one anterior and another posterior to the aorta. The reported incidence is 2-17% in autopsy studies and 1-11% in imaging literature (Beckmann and Abrams, 1980). It is a potentially hazardous anomaly since failure to recognize the dorsal component during surgery may lead to hemorrhage (Brener et al., 1974). There have been reports of accidental disruption of the posterior component of the left renal vein leading to haemorrhage and death (Brener et al., 1974).

The occurrence of a circumaortic renal collar can be explained on the basis of embryological development. The primary venous drainage prior to the sixth week is through the posterior cardinal veins (Arey, 1975). These are replaced by the eighth week at renal level by four longitudinal channels: the paired supracardinal veins which lie on a plane posterior to the aorta and the paired subcardinal veins which lie at a plane anterior to the aorta (Arey, 1975). There are rich anastomotic communications between the supracardinal-subcardinal, intersupracardinal and intersubcardinal channels, which form a plexus or a collar of veins around the aorta. Paired embryonic vessels on each side unite the kidneys with the right and left suprasubcardinal anastomoses (Arey, 1975). The retroaortic components normally atrophy, leaving a preaortic left renal vein. When the reverse occurs, the left renal vein is retroaortic. With the persistence of the entire ring, permanent channels will be found both anterior and posterior to the aorta (Mity, 1975). The circumaortic collar also poses potential hazards to surgeons during abdominal aortic surgery. In repair of an abdominal aortic aneurysm where the aorta is mobilized, the circumaortic collar becomes an even larger obstacle. The risk of accidentally damaging a circumaortic collar is higher for surgeons who routinely dissect the aorta circumferentially to apply proximal cross-clamping. Careful preoperative evaluations are important for establishing the presence of an associated venous anomaly to ensure the success of abdominal surgery (Satyapal et al., 1999; Karkos et al., 2001; Kudo et al., 2003).

In recent years, interest in the surgical and medical aspects of accessory renal arteries has been high. Transplanting a kidney with accessory renal arteries has several theoretical disadvantages – acute tubular necrosis and rejection episodes, decreased graft function, and prolonged hospitalization (Gunenc and Denk, 2006).

Accessory hilar renal arteries and accessory vessels to the upper and/or lower poles of the kidneys occur due to the persistence of some arteries of the urogenital rete arteriosum (Bayazit et al., 1992; Kadir et al., 1986).

Considering the position of anomalous arrangements of hilar structures, past studies have prohibited anterior incisions at the ureteropelvic junction and also the postero and posterolateral aspect (Sampaio and Favorito, 1993). Instead, they have advised a deep lateral incision along the ureteropelvic junction (Sampaio and Favorito, 1993). Such incisions may be helpful during endopyelotomies and may decrease the cost incurred during preoperative imaging.

ACKNOWLEDGMENTS

We thank Dr. Narga Nair, HOD of Anatomy, Kasturba Medical College, Manipal for her support.

REFERENCES

- AREY LB (1954). *Developmental Anatomy*, 6th Ed. W.B. Saunders Company, Philadelphia, pp 382-385.
- BAYAZIT M, GOL MK, ZORLUTUNA Y, TASDEMIR O and BAYAZIT K (1992). Bilateral triple renal arteries in a patient with iliac artery occlusion: A case report. *Surg Radiol Anat*, 14: 81-83.
- BECKMANN CF and ABRAMS HL (1980). Renal venography: Anatomy, technique, applications: Analysis of 132 renograms and review of literature. *Cardiovasc Intervent Radiol*, 3: 45-70.
- BERGMAN RA, THOMPSON SA, AFIFI AK and SAADEH FA (1988). *Compendium of Human Anatomic Variation: Catalog, Atlas and World Literature*. Urban & Schwarzenberg, Baltimore.
- BRENER BJ, DARLING RC, FREDERICK PL and LINTON RR (1974). Major venous anomalies complicating abdominal aortic surgery. *Arch Surg*, 108: 159-165.
- GILLOT C (1978). La veine renale gauche etude anatomique, aspects angiographiques, abord chirurgical. *Anat Clin*, 1: 35-55.
- GUNENC C and DENK C (2006). Combined unusual anatomical variations of the superior mesenteric and right renal arteries. *Clin Anat*, 19: 716-717.
- KADIR S (1986). *Diagnostic angiography*, 1st Ed. Saunders, Philadelphia, pp 445-495.

- KARKOS CD, BRUCE IA, THOMSON GJ and LAMBERT ME (2001). Retro-aortic left renal vein and its implications in abdominal aortic surgery. *Ann Vasc Surg*, 15: 703-708.
- KUDO FA, NISHIBE T, MIYAZAKI K, FLORES J and YASUDA K (2003). Left renal vein anomaly associated with abdominal aortic aneurysm surgery: Report of a case. *Surg Today*, 33: 609-611.
- MITY HA (1975). Circumaortic renal collar, a potentially hazardous anomaly of left renal vein. *Am J Roentgenol*, 125: 307-310.
- POLLAK R, PRUSAK BF and MOZES MF (1986). Anatomic abnormalities of cadaver kidneys procured for purposes of transplantation. *Am Surg*, 52: 233-235.
- SAMPAIO FJ and ARAGAO AHM (1990). Anatomical relationship between the renal venous arrangement and the kidney collecting system. *J Urol*, 144: 89-93.
- SAMPAIO FJ and FAVORITO LA (1993). Ureteropelvic junction stenosis: vascular anatomical background for endopyelotomy. *J Urol*, 150: 1787-1791.
- SATYAPAL KS, KALIDEEN JM, HAFEEJEE AA, SINGH B and ROBBS JV (1999). Left renal vein variations. *Surg Radiol Anat*, 21: 77-81.
- SENECAIL B, BOBEUF J, FORLODOU P and NONENT M (2003). Two rare anomalies of the left renal vein. *Surg Radiol Anat*, 25: 465-467.
- TESTUT L and LATAJET A (1947). *Tratado de Anatomia Humana*. 8^a Ed. Salvat Editores, Barcelona.
- URBAN BA, RATNER LE and FISHMAN EK (2001). Three dimensional volume-rendered CT angiography of the renal arteries and veins: Normal anatomy, variants and clinical application. *Radiographics*, 21: 373-386.