



RETROAORTIC LEFT RENAL VEIN OR POSTERIOR NUTCRACKER SYNDROME: A RARE ANOMALY

Radio-Diagnosis

Dr Prathamesh Vijay Kotawadekar 2nd year Post-graduate Radiodiagnosis resident, Department of Radiodiagnosis, Dr. D. Y. Patil Medical College Hospital and Research Centre, Kolhapur.

Dr. Bandi Babita Goud 2nd year Post-graduate Radiodiagnosis resident, Department of Radiodiagnosis, Dr. D. Y. Patil Medical College Hospital and Research Centre, Kolhapur.

Dr. Abhijit Magdum DNB Radiodiagnosis, Krystal Scan, Kolhapur.

Dr. Pradeep S. Patil Professor, M.D Radiodiagnosis, Department of Radiodiagnosis, Dr. D. Y. Patil Medical College Hospital and Research Centre, Kolhapur.

ABSTRACT

The term "Retroaortic Left Renal Vein" refers to a left renal vein that passes behind the abdominal aorta, and this anomaly is a rather unusual occurrence. It has been suggested that retroaortic left renal vein may cause symptoms such as haematuria and abdominal or flank pain. Urological symptoms are likely due to increased pressure in the left renal vein secondary to the posterior nutcracker phenomenon. We describe a highly uncommon case of a 35 year old woman who was admitted via the emergency department due to left sided flank pain for several days. A thorough examination with Contrast-enhanced CT revealed left renal vein compressed in between abdominal aorta and anterior margin of L1 lumbar vertebral body causing severe compression and mild proximal dilatation of left renal vein, with multiple venous collaterals majorly draining into the hemiazygos vein and the rest in inferior vena cava. The left gonadal vein appeared dilated. These features were suggestive of posterior nutcracker syndrome.

KEYWORDS

Renal Vein; Variation: Retroaortic Left Renal Vein

INTRODUCTION

Renal vein anatomical variations and congenital malformations have been characterized by Gillot and Bergman et al. The retroaortic route is one of the various varieties of the left renal vein that is considerably less well-known. The term "retroaortic left renal vein" refers to a left renal vein that passes behind the abdominal aorta, and it is a rather uncommon condition to have this abnormality. This condition affects women more than males, and it typically manifests in the third or fourth decades of life. Retroaortic left renal veins are divided into four different categories of which type 1 retroaortic left renal vein is most common type.[1,2] Retroaortic left renal veins are of surgical importance when a left renal surgery is considered. Failure to detect these anomalies could result in serious haemorrhage and kidney damage. In order to prevent complications during retroperitoneal surgery or interventional procedures, it is critical to recognize it.

Compression of the retroaortic left renal vein between the aorta and the vertebra cause urological problems such as haematuria, varicocele, and ureteropelvic junction obstruction.[1,2,4] Over time, this increased drainage pressure in the afferent venous system can lead to pelvic congestion syndrome in women and left-sided varicocele in men. First-line imaging with Doppler ultrasound enables the detection of left renal vein stenosis, potential renal failure, and varicocele secondary to venous congestion in the left renal vein. A CE-CT scan allows for the precise detection of vascular structures, their relationship to surrounding organs, and the exclusion of other compression-related causes.

Case Presentation

A 35 year old women had periodic left sided abdominal flank pain and history of infrequent haematuria in the past. There was no history of trauma, any menstrual complaints or fever. On initial ultrasound of abdomen-pelvis left kidney size was mildly enlarged. There were no kidney or ureteric calculi while the rest of the organs were normal.

The patient underwent Contrast CT, which revealed mild bulky left kidney and the left renal vein compressed in between abdominal aorta and anterior margin of L1 lumbar vertebral body causing severe compression and mild proximal dilatation. Multiple venous collaterals were seen at the level of the left renal hilum, majority of which were seen draining into the hemiazygos vein and the rest in inferior vena cava. Left gonadal vein appeared dilated. These features were suggestive of posterior nutcracker syndrome. (Figure A,B,C,D)

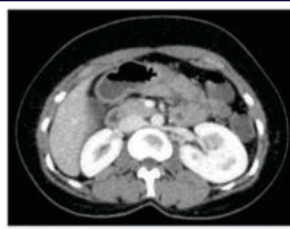


Figure A : CE CT (venous phase) – Showing left renal vein compressed between aorta and anterior margin of L1 vertebral body with mild proximal dilatation



Figure B : CE CT (venous phase) - Multiple venous collaterals were seen at the level of the left renal hilum, majority of which were seen draining into the hemiazygos vein and the rest in inferior vena cava.



Figure C : CE CT reconstructed coronal image – Showing dilated left gonadal vein.

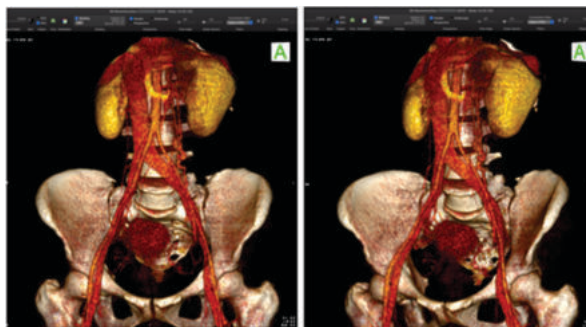


Figure D : CE CT 3D reconstructed image – Showing dilated left gonadal vein along its course.

Also, the patient underwent renal doppler ultrasound which showed that the left renal vein had variable course between aorta and vertebral body and it was compressed. There was aliasing on the right of aorta with increased PSV of the left renal vein around 60 cm/s - suggestive of post stenotic venturi effect. No history of renal thrombosis. There was mild dilatation of proximal gonadal vein. (Figure 1,2,3)

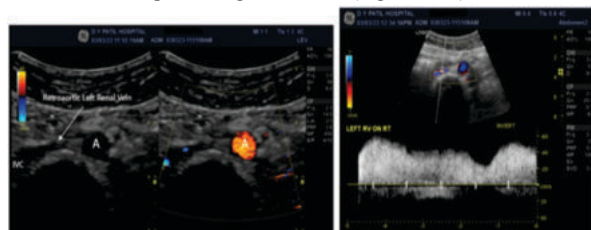


Figure 1 : Left renal vein with variable course between the aorta and vertebral body with increased PSV of stenosed renal vein around 60 cm/s

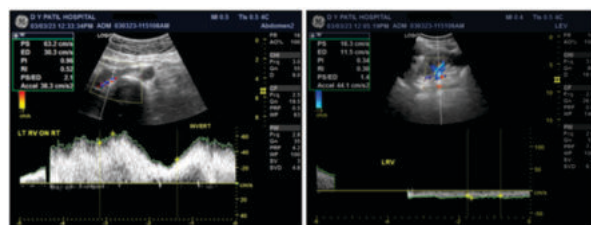


Figure 2 : Stenosed Left renal vein PSV under Venturi effect - (A) Post stenotic- 63.2 m/s (B) Pre stenotic near hilum- 16.3 cm/s



Figure 3 : Left Renal Artery and Vein with their corresponding dopplers

The patient was managed on conservative treatment and did not have other complications such as pelvic congestion syndrome. Hence a follow up was suggested, as any endovascular or surgical intervention is usually indicated, only in cases of persistent haematuria, severe flank pain, or serious dysfunction.

DISCUSSION

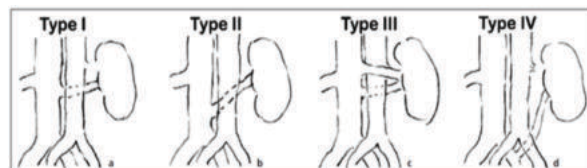
The intricate process of the inferior vena cava's development includes the development of the renal veins. Beginning in the fourth week of conception, the process lasts until about the eighth week. Three pairs of parallel veins form a vast network in the communication, the posterior cardinal veins, subcardinal veins, and supracardinal veins in order of appearance. The four segments of the inferior vena cava are created by the regression and persistence of these veins wherein the Hepatic portion is formed from the hepatic sinusoids and hepatic vein, the right subcardinal vein forms the Prerenal portion, the Renal part from anastomosis between subcardinal and supracardinal veins and the Postrenal part from right subcardinal vein. The subcardinal and supracardinal veins continue to anastomose, resulting in the formation of the renal veins. Duplication of the inferior vena cava, transposition of the inferior vena cava (left IVC), circumaoctic (left) renal vein, retroaoctic (left) renal vein, and absence of the hepatic portion of the inferior vena cava are some of the major venous anomalies of the inferior vena cava. The dorsal limb of the embryonic left renal vein and the dorsal arch of the renal collar (intersupracardinal anastomosis) persists, resulting in both circumaoctic and retroaoctic left renal veins. However, the ventral arch retracts in the retroaoctic left renal vein, allowing a single renal vein to pass posterior to the aorta.[3]

The "Retroaoctic left renal veins" are divided into four different categories, according to where they join the IVC:^[1,2]

- (1) those that join the IVC orthotopically (Most Common)
- (2) those that join the IVC at the level of L4-L5.
- (3) those that form a collar around the aorta and include both anterior and retroaoctic LRVs.
- (4) and those that join the left common iliac vein.

According to the theory, increased pressure in the left renal vein caused by compression of the left renal vein, causes haematuria and results in congestion of the left kidney and venous communications.[1,2,4] It is

known that the gonadal, ascending lumbar, adrenal, ureteral, and capsular veins are potential collateral venous pathways in cases of renal vein compression or obstruction. These anomalous communication channels are responsible for haematuria. This increased drainage pressure in afferent venous system, overtime can cause left-sided varicocele in men and pelvic congestion syndrome in women.



Classification scheme of the RLRV: (a) Type I that joins the IVC orthotopically ; (b) Type II that joins the IVC at lower level of L4-L5 ; (c) Type III circumaoctic renal vein collar - composed of both preaoctic and orthotopic retroaoctic renal veins ; (d) Type IV that joins the left common iliac vein.

In retroperitoneal surgery, diagnosis of the renal vein anomalies is essential information. Since failing to recognize this circumstance during retroperitoneal surgery may cause bleeding, nephrectomy, and even death. Due to its length, the left renal vein is preferred in renal transplants. Hence It is crucial to understand the left renal vein's trajectory. For a distinct diagnosis of retroperitoneal lymph node pathologies in patients with renal or testicular tumours, it is also important to be aware of renal vein anomalies.

For treatment, endovascular or surgical intervention may be indicated, after 2 years of follow-up, in cases of persistent haematuria, severe flank pain, or serious dysfunction.

However, it is observed that placing a stent between the vertebral column and the aorta is not safe because it might lead to aortic wall erosion and the development of an arterovenous fistula. For the treatment of Posterior Nutcracker syndrome, open surgery with Left renal vein transposition has been suggested to relieve compression.[5]

CONCLUSION

In conclusion, the retroaoctic left renal vein rarely causes symptoms. It may sometimes cause haematuria, flank pain, varicocele in men, pelvic congestion syndrome in women and abdominal pain. If any retroperitoneal surgery or interventional procedures or any other surgical procedure is recommended in this region, it is crucial to confirm the presence of Retroaoctic left renal vein. By using CT, MRI, or conveniently ultrasound, the abnormality could be quickly and easily identified. Due to its numerous advantages, colour Doppler ultrasound is the most effective modality for finding this anomaly, with convenience being the most crucial factor.

REFERENCES

- [1] Krastev N, Tivcheva Y, Malinova L, Jeleu L. Retroaoctic left renal vein: a clinically significant vascular variation with suggestion of a practical typological scheme. *Anatomy*. 2022 Apr 1;16(1):41-5.
- [2] Hsieh CL, Tiao WM, Chou YH, Tiu CM. Retroaoctic left renal vein: Three case reports. *Journal of Medical Ultrasound*. 2012 Jun 1;20(2):115-8.
- [3] Tatar I, Töre HG, Celik HH, KARCAALTINCABAM. Retroaoctic and circumaoctic left renal veins with their CT findings and review of the literature. *Anatomy*. 2008;2(1).
- [4] Cecilia Gozzo*, Renato Farina, Pietro Valerio Foti, Francesco Aldo Iannace, Andrea Conti, Isabella Pennisi, Serafino Santonocito, Stefano Palmucci and Antonio Basile. Posterior nutcracker syndrome: a case report. *Gozzo et al. J Med Case Reports* (2021)15:42
- [5] Marone EM, Psacharopulo D, Kahlberg A, Coppi G, Chiesa R. Surgical treatment of posterior nutcracker syndrome. *Journal of vascular surgery*. 2011 Sep 1;54(3):844-7.