Journal of Morphological Sciences
J Morphol Sci
Brazilian Society of Anatomy

Case Report
J Morphol Sci 2023;40:390-392

Left Sided Inferior Vena Cava & Abnormal Ddrainage of Gonadal Veins: a Short Review and a Case Report

Pushpalatha K[1], Rashmi C Goshi[2], Rohith Yadav Gummadi[3]

[1]Professor, Department of Anatomy, JSS Medical College, Mysuru
[2]Assistant Professor, Department of Anatomy, JSS Medical College, Mysuru
[3]Post graduate, Department of Anatomy, JSS Medical College, Mysuru

Disclose and conflicts of interest: none to be declared by all authors

ABSTRACT

Introduction: the biggest and broadest vein in the body, the Inferior Vena Cava carries the majority of blood away from the diaphragm and into the right atrium of the heart. A uncommon congenital defect known as an inferior vena cava (IVC) developmental anomaly affects around 4% of the general population. Gonadal vein variations are also frequent and play a crucial role in procedures on the posterior abdominal wall. In the JSS Medical College department of anatomy, we discovered a left-sided IVC and a difference in the drainage of the gonadal veins during the usual dissection of a 78-year-old male patient. When doing procedures for varicocele, undescended testes, and kidney transplants, understanding the architecture of the gonadal veins is crucial. Laparoscopic surgery complications result from lack of understanding the anatomical peculiarities of the procedure.

Keywords: Inferior vena cava; Gonadal veins; Laproscopy.

Introduction

The Inferior Vena Cava is the largest and widest vein and drains most of the blood from the body below the diaphragm into the right atrium of the heart. The Inferior Vena Cava is formed by the union of right and left common iliac veins in front of the body of L5 vertebra, below the aortic bifurcation, and behind the right common iliac artery. The development of the Inferior vena cava is a complex process that results in several uncommon malformations[1]. Developmental anomaly of the inferior vena cava (IVC) is a rare congenital anomaly that affects approximately 4% of the population. These anomalies are unique or can be associated with other anomalies[2]. The most common anomalies are transposition IVC, double inferior vena cava, retro-aortic left renal vein[1].

The gonadal veins are asymmetric anatomically. The testicular veins originate from the pampiniform plexus, and they condense to form four veins at the superficial inguinal ring, and then they unite to form two veins at the deep inguinal ring and they fuse to form single vein in the abdomen. The left testicular vein drains in the left renal vein and, but the right testicular vein drains directly in the inferior vena cava (IVC)[3].

Variations of Gonadal veins are also common which are important during surgeries of posterior abdominal wall. As gonadal veins are closely related to renal vessels, and its variations are of greatest importance in renal surgeries[4].

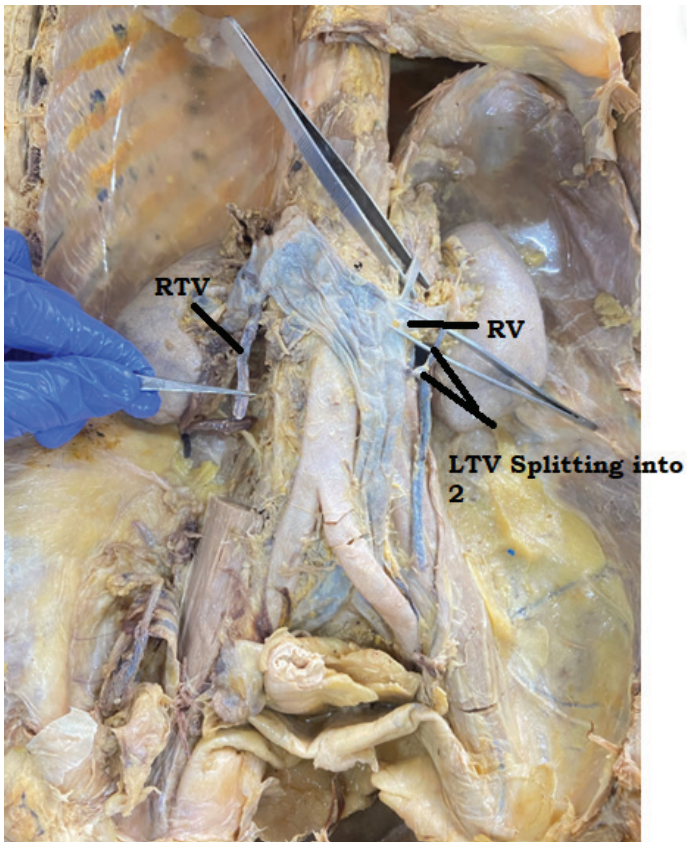
The gonadal veins are of greatest clinical significance during laparoscopic surgery and in transplantation of kidney and it is readily available material for vascular reconstruction. Knowledge of gonadal vein variations aid the radiologists and surgeons in recognition and protection of these veins, which play major roles in the thermo-regulation[3].

We report a case of left sided IVC associated with abnormal drainage of gonadal veins.

Case report

During the routine dissection in a 78-year-old male at department of Anatomy, JSS Medical College, we found a left sided IVC and variation in the drainage of gonadal veins. At the bifurcation of the common iliac artery, IVC was formed by right & left iliac vein at the level of L5 vertebrae. Inferior vena cava was passing behind the left common iliac artery and ascends on the left side of abdominal aorta. At the level of hilum of the kidney IVC crosses from left to right over the abdominal aorta and takes a regular course and drains into right atrium. The left gonadal vein was splitting, and one was draining into the left renal vein and another into inferior vena cava. The right gonadal vein is directly draining into the right renal vein instead of inferior vena cava.

DOI: 10.51929/jms.40.390.2023
ISSN 2177-0298



Discussion

The process of embryogenesis takes place in between the fourth to eighth weeks of gestation by the sequential formation, anastomoses, and regression of three paired fetal venous systems, the posterior cardinal, subcardinal and the supracardinal systems. IVC is formed by the right anomalies of IVC. Aberrations in the development of these venous systems result in variations. Regression of the left supracardinal vein results of double IVC, and regression of the right supracardinal vein and persistence of right supracardinal vein results in the formation of left-sided IVC[5,6,1].

The incidence of IVC anomalies ranges from 0.3-0.5%[7]. These variations are rare; however, it is important to show and diagnose these variations by radiological methods before surgery[1]. In prevalence of left sided IVC is 0.2– 0.5%[1,8].

Left and double IVC are two major variations and they are due to developmental abnormalities of the supracardinal veins[9].

The left IVC usually joins the left renal vein and crosses over to the right at the level of the renal veins anterior to the aorta and continues as normal (right-sided) IVC[10]. Aliakbarian etal found 2 cases of left IVC, in one case it was joining with renal vien and crossing to right then taking a normal course but in one case there was no retrohepatic IVC and hepatic veins were directly draining into the right atrium[11].

In incomplete left sided IVC, the left common iliac vein ascends as a duplicated left IVC and drains into the left renal vein, and it crosses the aorta anteriorly and joins the right IVC in a normal fashion. In complete left-IVC, the left IVC receives the left renal vein and continues as a preaortic trunk that travels obliquely and empties into the right IVC. Left IVC can be mistaken as a left-sided para-aortic adenopathy and it should also be considered during placing of IVC filter by interventional radiologists[8].

A left IVC draining into the hemiazygous vein, that joins with azygous and draining into SVC. This pattern is not consistent with the common left IVC variations reported in the literature[12].

The infrarenal region hypoplastic of IVC seen in two patients and hypoplasia of infrarenal and suprarenal regions of the IVC seen in two cases, complete aplasia of the IVC except for a small part of the suprahepatic seen in one case[13].

Agenesis is an underestimated incidence estimated in less than 1%. The agenesis can be incomplete (absence of either suprarenal or infra renal part of IVC) or complete, absence of the entire IVC[2].

The anatomy of the gonadal veins is important during surgeries like varicocele, undescended testes, and renal transplantations. Complications in laparoscopic surgery are due to unaware of anatomic variations of that operative field. Variations of drainage of gonadal vein are due to fault in development in venous shift and alteration in anastomotic channel of post-cardinal, supra-cardinal and sub cardinal veins. Testicular veins variations are more common in the left side[3].

Gonadal vein develops from caudal part of sub-cardinal vein drains into the supra-sub cardinal anastomosis. In the right side, this supra- sub cardinal anastomosis is incorporated into the formation of IVC and the left sideit forms part of left renal vein, so right gonadal vein normally drains into the IVC and left into left renal vein[14].

In the present case left gonadal vein was splitting and one was draining into the left renal vein & another was into inferior vena cava, and the right gonadal vein is directly draining into the right renal vein.

Normally left testicular vein drains into left renal vein and right into IVC. Left testicular vein can drain into IVC (1.1%), and right testicular drain into right renal vein (8%)[15]. Testicular vein can drain as a single tributary or as double.

Double left testicular vein seen in 15.4% of cases of which one testicular vein was draining into left renal vein while the other was draining into circumaortic renal vein. Drainage of right testicular vein into right renal vein was seen in 3 cases (11.5%)[4]. Rosalino etal found a rare variation where in left gonadal vein was penetrating the inferior pole of the left kidney and then draining into a tributary of the renal vein[16].

Variations of gonadal veins were seen in 21.3% of the cadavers and more common on the left side

and bilateral variations were seen in 8.8% of cases[17]. Variations are more common in testicular than ovarian veins, 45% cases, testicular veins showed variations on number and drainage[3]. Variations on left side in 30% cases as compared to right 15% but in 4 (10%) cases, the variations were present bilaterally. Duques *et al*.,[18] found a single testicular vein in 85.2% and double in 8.8% of cases, but Lechter *et al*.,[19] double testicular veins occurred in 5% of cases in right side. Double testicular vein is reported by many but splitting of testicular vein is not reported so far.

Gonadal vein is used for vascular reconstruction and adequate knowledge minimizes the complications[20]. Transplantation of the right kidney is challenging as the right renal vein is shorter and elongation of the right renal vein very important. Right renal vein can be lengthened by using gonadal veins[21,22], so the variation of right gonadal vein is very important during transplantation of right kidney. The comprehensive knowledge of variations in gonadal veins is of paramount importance during renal transplantation for surgeons, urologist, and radiologists.

Conclusion

For any surgical or hemodynamic technique to be successful, study and understanding of normal anatomy and its variations are crucial. This is especially true for transplant procedures, when organ recovery is a dissection lesson with each organ's vascularization being completely unique. On the back table, these vascular reconstructions are carried out as organs are being prepared. Consequently, understanding the different IVC variances would not only enable improved surgical outcomes but also enable the prevention of unintentional injuries that frequently have devastating outcomes.

References

1. Alper Dilli a,, Umit Yasar Ayaz b, Hatice Kaplanoğlu b, Hakan Saltas c, Baki Hekimoglu. Evaluation of the left renal vein variations and inferior vena cava variations by means of helical computed tomography. Clinical Imaging. 2013;37: 530–535.
2. Morosetti D, Picchi E, Calcagni A, Lamacchia F, Cavallo AU, Bozzi A etal. Anomalous development of the inferior vena cava: Case reports of agenesis and hypoplasia. Radiology Case Reports. 2018; 13: 895 – 903.
3. Gupta R, Gupta A, Aggarwal N. Variations of Gonadal Veins: Embryological Prospective and Clinical Significance. Journal of Clinical and Diagnostic Research. 2015; 9(2): AC08-AC10.
4. PreetiSonje, Neelesh Kanasker, PVatsalaswamy. Variations in the Origin and Draining Pattern of Gonadal Vessels with their Surgical Significance and Developmental Correlations. IndianJAnat. 2020;9(1):39-43.
5. Rajabnejad Y, Aliakbarian M, Rajabnejad A, Motie MR. Left-sided inferior vena cava encountered during organ retrieval surgery: report of two cases. International Journal of Organ Transplantation Medicine. 2016;7(4):229.
6. Khamanarong, K. Double inferior vena cava and associated venous anomalies: a case report. J. Morphol. Sci. 2017;34 (4): 215-217.
7. Sitwala PS, Ladia VM, Brahmbhatt PB, Jain V, Bajaj K. Inferior vena cava anomaly: a risk for deep vein thrombosis. North American Journal of Medical Sciences. 2014 Nov;6(11):601.
8. Ghandour A, Partovi S, Karuppasamy K, Rajiah P. Congenital anomalies of the IVC—embryological perspectives and clinical relevance. Cardiovasc Diagn Ther. 2016;6(6):482-492.
9. Ang WC, Doyle T And stringer MD. Left-Sided and Duplicate Inferior Vena Cava: A Case Series and Review. Clinical Anatomy. 2012.
10. M. Malaki, A.P. Willis, R.G. Jones. Congenital anomalies of the inferior vena cava. Clinical Radiology. 2012; 67:165e171.
11. Aliakbarian YRM and Motie ARMR. Left-Sided Inferior Vena Cava Encountered During Organ Retrieval Surgery: Report of Two Cases. Int J Org Transplant Med 2016; 7 (4.).
12. Petik B. Inferior vena cava anomalies and variations: imaging and rare clinical findings. Insights Imaging. 2015; 6:631–639.
13. Baeshko AA, Zhuk HV, Ulezko E A, Goresckaya IV, Oganova EG, Dudarev VS and Orlovski YN. Congenital Anomalies of the Inferior Vena Cava and their Clinical Manifestation. EJVES Extra. 2007; 14: 8-13.
14. Sharma P, Salwan SK. Anomalous Right Testicular Artery and Vein: Embryologic Explanation and Clinical Implications. Journal of Clinical and Diagnostic Research. 2011 December, 5(8): 1631-1633.
15. Brendan Barber, Alexander Horton, and Uday Patel, Punita Sharma, Surinder Kumar Salwan. Anatomy of the Origin of the Gonadal Veins on CT. J Vasc Interv Radiol 2012; 23:211–215.
16. Rosalino, UAC., Latorre, GC., Pinto, AC.* and Toscano, MP. Uncommon drainage of the gonadal vein: case report. J. Morphol. Sci., 2011,28(2): 135-136.
17. Asala S, Chaudhary SC, Masumbuko-Kahamba N, Bidmos M. Anatomical variations in the human testicular blood vessels. Ann Anat. 2001;183(6):545-49.
18. Duques P, Rodrigues JR, Silva Neto FB, Neto EMVS, Toledo ES. Estudoanatômico da veia renal esquerda de cadavershumanosbrasileiros. MedicinaRibeirãoPreto. 2002; 35:184-91.
19. Lechter A, Lopez G, Martinez C, Camacho J. Anatomy of the gonadal veins: a reappraisal. Surgery. 1991;109(6):7335-39.
20. Dey S, Kundu B, Bhakta A. A Study on Numeric Variation of Gonadal Veins in Eastern India: Embryological Aspect and Its Application. Journal of Dental and Medical Sciences. 2018; 17(1):72-74 .
21. Jia-Yu Feng 1, Chi-Bing Huang, Ming-Qi Fan, Ping-Xian Wang, Ya Xiao, Gen-Fu Zhang. Renal vein lengthening using gonadal vein reduces surgical difficulty in living-donor kidney transplantation. World J Surg. 2012; 36:468–472.
22. Chun-hua Lin, Ke Wang, Hui Wang, Jian-tao Wang, Qing-zuo Liu, Sheng-qiang Yu etal. Right renal vein elongation using gonadal vein during retroperitoneoscopic living donor kidney transplantation: a single-center experience. Clin Transplant 2014: 28: 1303–1304.

Received: April 1, 2023
Accepted: May 12, 2023

Corresponding author
Rashmi C Goshi
E-mail: rashmicgoshi@jssuni.edu.in