Variation in inferior vena cava with persistence of left posterior cardinal vein. A case report

KS Basnet and S Dhungel

Department of Anatomy, Nepal Medical College, Jorpati, Kathmandu, Nepal

Corresponding author: Dr. Kishore Singh Basnet, Department of Anatomy, Nepal Medical College, Jorpati, Kathmandu, Nepal; e-mail: drksbasnet@gmail.com

ABSTRACT

Left sided single inferior vena cava is a rare developmental anomaly affecting clinical diagnosis, treatment and raising academic quest. Incidentally, a similar case was found in the museum of the Department of Anatomy of Nepal Medical College. Along with the anomaly, there were other associated vascular anomalies. The article discusses the possible causative situations.

Keywords: Inferior vena cava, developmental anomaly, museum specimen.

Preoperative identification of a congenital anomaly of the inferior vena cava (IVC) is critical for an uneventful completion of retroperitoneal surgery.[1] Therefore, the knowledge of variations in the venous drainage of the abdominal cavity has become essential with the advancement in abdominal surgeries including organ transplantation, prophylaxis in cases of thrombo-embolism through ligation of inferior vena cava and for diagnostic MRI and CT Scanning etc. Though minor variations are common, major ones are usually infrequent. Only fifteen cases of left sided single inferior vena cava had been reported throughout the nineteenth century.[2] The prevalence of left IVC is 0.2% to 0.5%.[3] Awareness of developmental interruption of the inferior vena cava with azygos or hemiazygos continuation is of critical importance in patients who may undergo shunt procedures for portal hypertension or other procedures involving the inferior vena cava.[4] Anomalies of IVC and its tributaries have been known to anatomists since 1793.[5] Embryogenesis of the IVC is a complex process involving the intricate formation and regression of numerous anastomoses, potentially leading to various anomalies.[6]

CASE REPORT

In the process of updating and rearranging the museum of the Anatomy Department, Nepal Medical College, a jar specimen of kidneys was found with a left sided inferior vena cava and unusually long right renal vein crossing abdominal aorta anteriorly. Both renal veins were found to receive gonadal and supra-renal veins. The termination of gonadal veins were equidistant from IVC, on the other hand, the termination of supra-renal veins were approximately equidistant from the hilum of the kidneys. The dimensions of the kidneys were normal (Table-1 and 2). The abdominal aorta was found on the right side of IVC. The right renal artery was found arising from the aorta half centimetre higher than the left renal artery (Fig 1).

DISCUSSION

Normally inferior vena cava develops form vitelline, subcardinal and right supracardinal veins. With the regression of suprahepatic part of left vitelline vein, the right vitelline vein enlarges to form right hepatocardiac channel which becomes the hepatocardiac portion of IVC. After the formation of left renal vein with the development of an anastomotic channel between right and left subcardinal veins, the right subcardinal vein develops into renal segment of IVC whereas the left subcardinal vein disappears except the distal portion which remains as left gonadal vein. The renal segment of IVC thus formed connects with the hepatic segment. The anastomosis between posterior cardinal veins forms the left common iliac vein and the proximal segment of left supracardinal vein disappears. The persistent right

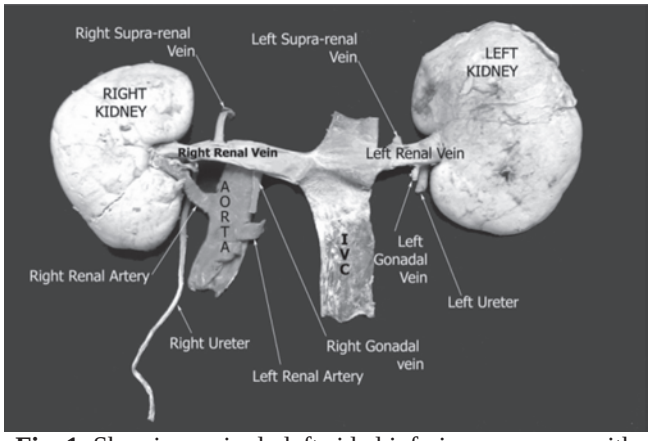

Fig. 1. Showing a single left sided inferior vena cava with its tributaries

Table-1: Showing the dimension of the right and left kidneys

	Length in cm	breadth in cm	Thickness in cm
Right Kidney	8	5	4
Left Kidney	8.5	5	4

Table-2: Showing the length of renal veins and point of entry of its tributaries

	Renal vein(cm)	Distance between the gonadal veins from IVC(cm)	Distance between suprarenalveins from the hilum of kidney(cm)
Right	6	1.75	2.25
Left	2.5	1.75	2

supracardinal vein develops into supracardinal segment of IVC[7] (Fig.2).

The present case is an example of rare anomaly. Study of the development of IVC in the domestic cat (Felis domestica) by Huntington and McLure have proposed a classification system for IVC anomaly based on abnormal regression or persistence of various embryonic veins.[8] The causation of a left IVC is due to regression of right supracardinal vein with persistence of left supracardinal vein.[5] A left IVC results from regression of the right supracardinal vein with persistence of the left supracardinal vein.[9] So, the blood is diverted through the left side with the persistence of left supracardinal vein resulting into left inferior vena cava.

Typically left IVC joins left renal vein which crosses anterior to aorta in a normal fashion and joining with the right renal vein ascends up forming a normal right IVC.[5] In the present case, the IVC remained on left side even cephalad to the renal vein termination therefore it

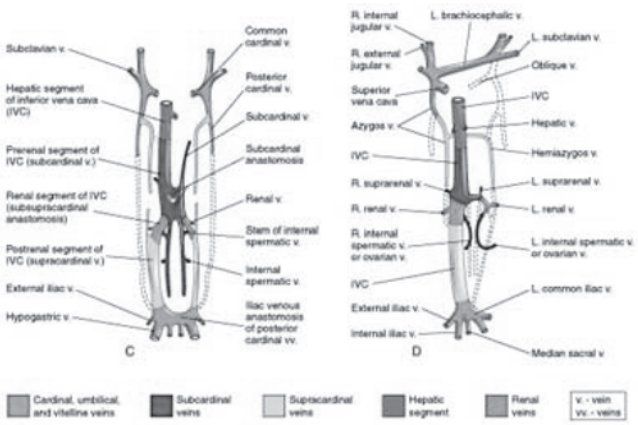

Fig. 2. Showing the normal pattern of IVC development. (Diagram taken from The Developing Human, Clinically Oriented Embryology, 8th Ed. Keith L. Moore, T.V.N.Persaud)

raises a possibility of its continuation as hemiazygos vein or it may cross the midline in the abdomen at L2 level and ascends up normally.[10] Such entity of left IVC with possibly hemiazygos continuation can be diagnosed by chest x-ray and upper abdominal sonography.[4]

Though the prevalence of left sided IVC is an uncommon entity, it will have a significant clinical significance. Therefore knowledge of this anomaly is essential to avoid diagnostic pitfall. Besides a plain chest x-ray and ultra sonogram, contrast enhanced CT is regarded a confirmatory diagnostic tool.[4,11] Those subjects who are contraindicated to contrast medium, MR. Imaging will be the answer.[3] If such type of anomaly is found during anatomical dissection it will be necessary and wise to trace the vessel up to its destination. Therefore, it is suggested to all concerned dissectors to study vigilantly and preserve the specimen properly so that it can be an academic material and will be proved helpful to the clinical diagnosis and treatment.

REFERENCES

1. Downey RS, Sicard GA, Anderson CB. Major retroperitoneal venous anomalies: surgical considerations. *Surg* 1990; 107: 359-65.
2. Becker FF, Federick F. A singular left sided inferior vena cava: *Anat Record* 1962; 143: 117-21.
3. Bass JE, Redwine MD, Kramer LA, Huynh PT, Harris JH Jr. Spectrum of congenital anomalies of the inferior vena cava: cross-sectional imaging findings. *Radiographics* 2000; 20: 639-52.
4. Train JS, Henderson MR, Smith AP. Sonographic demonstration of left-sided inferior vena cava with hemiazygos continuation. *Amer J Radiol* 1980*;* 134; 1057-9.
5. Abernethy J. Account of two instances of uncommon formation in the viscera of the human body. *Philos Trans R Soc* 1793; 83; 59-66.
6. Cannon Milani C, Constantinou M, Berz D, Butera JN, Colvin GA. Left sided inferior vena cava duplication and venous thromboembolism: case report and review of literature. *J Hematol Oncol* 2008; 1: 24-31.
7. Sadler TW. Langman's Medical Embryology 9th Ed. Lippincott Williams and Wilkins; Baltimore. 2004; 223-74.
8. Huntington GS, McClure CFW. The development of the veins in the domestic cat (Felis domestica) with especial reference, 1) to the share taken by the supracardinal veins in the development of the postcava and azygos veins and, 2) to the interpretation of the variant conditions of the postcava and its tributaries as found in the adult. *Anat Rec* 1920; 20: 1-30.
9. Giordano JM, Trout HH. Anomalies of the inferior vena cava. *J Vasc Surg* 1986; 3: 924-8.
10. Haswell D, Berrigan T. Anomalous inferior vena cava with accessory hemiazygos continuation. *Radiol* 1976; 119: 51-4
11. Aljabri B, MacDonald PS, Satin R, Stein LS, Obrand DI, Steinmetz OK. Incidence of major venous and renal anomalies relevant to aortoiliac surgery as demonstrated by computed tomography. *Ann Vasc Surg* 2001; 15: 615-8.