



# Duplication of Inferior Vena Cava- A Rare Case Report

Saad M. Al-Shibli <sup>\*1</sup>, Emad M. Nafie <sup>2</sup>, Ghassan A. Jabir <sup>3</sup>

<sup>1</sup>Department of Basic Medical Sciences, Faculty of Medicine, International Islamic University Malaysia, Pahang, Malaysia

<sup>2</sup>Lincoln University College Malaysia

<sup>3</sup>Al-Karada Primary Care Centre, Ministry of Health, Baghdad, Iraq

\*Corresponding author: Saad M. Al-Shibli; [salshibli2004@yahoo.com](mailto:salshibli2004@yahoo.com)

Received 24 August 2020;

Accepted 06 September 2020;

Published 15 September 2020

## Abstract

The inferior vena cava (IVC) is the biggest vein in the human being that started as the result of the union of the right and left common iliac veins at the level of the fifth lumbar vertebra. IVC develops as part of the embryonic venous system which is divided into vitelline, umbilical and cardinal system at the beginning of the 5th week. Double IVC incidence ranges between 0.2% - 3%. The variation was detected through dissecting a cadaver in the Faculty of Medicine, International Islamic University Malaysia. We report a left sided IVC accompanied side by side to the normal right one. They joined together by a connecting venous anastomosis at the level of first lumbar vertebra. Double IVC can prolong smoothly without any consequences and may be discovered incidentally by radio-graphical studies, but in some conditions like retroperitoneal surgery, vascular interventional procedures, the study of the anatomy of these variations is of crucial importance.

**Keywords:** *Inferior vena cava, duplication, congenital variation*

## Introduction

The inferior vena cava (IVC) is the biggest vein in the human being that started as the result of the union of the right and left common iliac veins at the level of the fifth lumbar vertebra. It ascends along the right side of the aorta. At the beginning of the 5th week IVC develops as part of the embryonic venous system which is divided into vitelline, umbilical and cardinal system. The vitelline venous system arises as a capillary plexus around the yolk sac and finally forms the hepatic blood sinusoids, portal venous system and the proximal portion of the IVC which joins the hepatic veins to the heart. The vitelline system form right and left vitelline veins while the umbilical venous system forms right and left umbilical veins.

During the 3<sup>rd</sup> and 4<sup>th</sup> week of the embryonic development, a new venous system is formed known as the cardinal venous system draining the cranial and caudal portions of the embryo via right and left anterior and posterior cranial veins <sup>[1]</sup>.

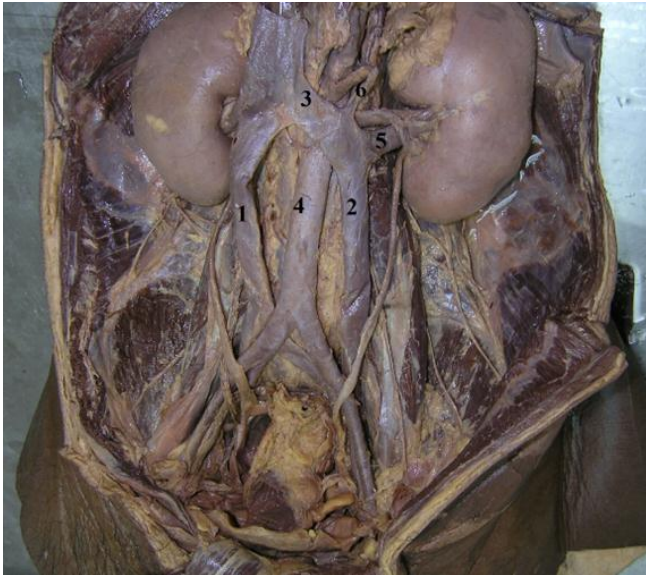
All these systems are bilaterally symmetrically arranged. However, during the 5th to 7th week more cardinal venous system forms cranio-caudally namely sub-cardinal venous system draining the kidneys and gonads; supra-cardinal venous system draining mainly the body wall by forming the azygos veins and finally the sacro-cardinal venous system draining the lower limb. Double IVC occurs if the left sacro-cardinal vein fails to lose its connection with the left sub-cardinal vein <sup>[2]</sup>.

Duplication of IVC is a rare congenital anomaly with an incidence of 0.2% - 3% <sup>[3]</sup>. Most of the reported cases are

diagnosed during different radiological imaging modalities like CT scan or MRI indicated for different medical conditions. Other cases were diagnosed during autopsy. Majority of these anomalies are symptomless, although they might have significant clinical implications in some surgical and radiological procedures particularly in retroperitoneal surgical procedures as lymph node dissection or urological procedures. Such variation might affect the accuracy of IVC catheterization in thromboembolic diseases <sup>[4]</sup>. To avoid significant morbidity in some of the surgical operations, new 3D spiral CT scan can help by identification of IVC anomalies <sup>[5]</sup>.

## Case Report

Our case was observed during dissection of the abdomen of an adult male cadaver in the dissection hall of Anatomy, Faculty of Medicine, International Islamic University Malaysia. In this report, the normal IVC exists on the right side and a left sided one was accompanied side by side. This left IVC begins by the union of both internal and external iliac vein dorsal to the left common iliac artery at the level of fifth lumbar vertebra. It ascend on the left side of the abdominal aorta starting from the fifth up to the first lumbar vertebra. At the level of left renal vein, it united with the normal IVC ventrally to the abdominal aorta at the level of first lumbar vertebra by connecting venous anastomosis. The left suprarenal vein drains to this connecting part between the right and left IVC.



**Figure 1: Right IVC (1) and left IVC (2) united by connecting vein (3). The abdominal aorta (4) lies between the two IVC. Left renal vein (5) drains to the left IVC and the left suprarenal vein (6) drains to connecting part between the two IVC.**



**Figure 2: Showing the origin of the left IVC (1) dorsal to the left common iliac artery (pulled medially) (2). The left common iliac vein (3) and the left ureter (4) also shown.**

## Discussion

Starting from the 5<sup>th</sup> week of gestation, the venous system of the embryo made up of three components; vitelline, umbilical and cardinal system that are bilaterally symmetrically arranged [6].

Normally the IVC obtained from the three pairs of primitive veins, which are the posterior cardinal, subcardinal, and supracardinal veins to form the final IVC by appearing and regressing. The postcardinal veins appear and remain in the pelvis forming the common iliac veins, the right supracardinal vein remain to form the infrarenal IVC, while the left subcardinal vein and the left supracardinal vein regress completely [3].

Any change in this process will influence multiple different anomalies of the IVC. As reported by Bass, major anomalies are duplication of IVC (with a prevalence of 0.2–3%). The duplication of IVC results from persistence of the right and the left supracardinal veins [7].

Our finding happened during cadaveric dissection in the dissecting hall of anatomy department. Most of such variations were discovered during radiological investigations for patients

referred for various medical indications. Duplication of IVC may be misdiagnosed as abnormal lymph node [8] or left pyelo-ureteric dilatation [2]. This may negatively affect the management plan of lymph node dissection, or pyeloplasty. Left sided IVC may be iatrogenically injured causing significant intraoperative haemorrhage during some retroperitoneal surgical interventions [9]. The ureter might be injured especially the one that take a retrocaval path to the left IVC which expose the ureter to some injuries during surgeries. Thromboembolic conditions are common in patients with IVC anomalies (60-80%). This duplication of IVC need to be recognised during vascular interventional procedures to avoid recurrent pulmonary embolism that may follow the placement of an IVC filter [10].

## Conclusion

Variations in the development of inferior vena cava is relatively uncommon particularly a double IVC, and can prolong smoothly without any adverse consequence abnormalities. In some conditions such as retroperitoneal surgery, vascular interventional procedures, and various surgical / radiological techniques, the study of the anatomy of these variations is of crucial importance.

## Ethics approval and consent to participate

Not applicable

## List of abbreviations

IVC: Inferior Vena Cava

CT: Computerised Tomography

MRI: Magnetic Resonance Imaging

## Data Availability

Not applicable

## Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

## Funding Statement

The first author (Saad M. Al-Shibli) funded this case report.

## Authors' contributions

Saad M. Al-Shibli found the variation in the cadaver in the dissection hall of anatomy, wrote the introduction and the case report with its conclusion, and funded the article.

Emad M. Nafei wrote the embryology part of the case report, participate in editing and proof reading.

Ghassan A. Jabir did the dissection, took the photos of the double IVC, and shared in the editing.

## Acknowledgments

We are most grateful to our colleagues, and staff in the BMS Department, College of Medicine, IUM; and to anatomy personnel in the dissection hall for their remarkable support.

## References

- [1] T.W. Sadler (2012) *Medical embryology* 12<sup>th</sup> edition. Philadelphia, PA; Lippincott Williams & Wilkins, a Wolters Kluwer. p. 191-194.
- [2] Pineda, D., et al., *An interesting anatomic variant of inferior vena cava duplication: case report and review of the literature*. *Vascular*, 2013. 21(3): p. 163-167.
- [3] Bass, J.E., et al., *Spectrum of Congenital Anomalies of the Inferior Vena Cava: Cross-sectional Imaging Findings 1: (CME available in print version and on RSNA Link)*. *Radiographics*, 2000. 20(3): p. 639-652.
- [4] Nishibe, T., et al., *Abdominal aortic aneurysm with left-sided inferior vena cava: report of a case*. *International angiology*, 2004. 23(4): p. 400.
- [5] Ang, W.C., T. Doyle, and M.D. Stringer, *Left-sided and duplicate inferior vena cava: A case series and review*. *Clinical Anatomy*, 2013. 26(8): p. 990-1001.
- [6] Banerjee, A., et al., *Duplication of the inferior vena cava—report of a rare congenital variation*. *International Journal of Anatomical Variations*, 2012. 5(1).
- [7] Kose, M.F., et al., *Anomalies of major retroperitoneal vascular structure*. *International Journal of Gynecological Cancer*, 2011. 21(7): p. 1312-1319.
- [8] Shindo, S., et al., *Anomalies of inferior vena cava and left renal vein: risks in aortic surgery*. *Annals of vascular surgery*, 2000. 14(4): p. 393-396.
- [9] Aljabri, B., et al., *Incidence of major venous and renal anomalies relevant to aortoiliac surgery as demonstrated by computed tomography*. *Annals of vascular surgery*, 2001. 15(6): p. 615-618.
- [10] Sartori, M.T., et al., *Double vena cava filter insertion in congenital duplicated inferior vena cava: a case report and literature review*. *Haematologica*, 2006. 91(6 Suppl): p. ECR30-ECR30.