ISSN 2563-7142

ORIGINAL ARTICLE

Variant Inferior Vena Cava Associated with Combined Variation of Renal and Testicular Arteries: A Case Report and Clinical Implications

George J Lufukuja[1*], Flora M Fabian[1,2], Michael Kilimba[1]

Lufukuja GJ, Fabian FM, Kilimba M. Variant Inferior Vena Cava Associated with Combined Variation of Renal and Testicular Arteries: A Case Report and Clinical Implications. Int J Cadaver Stud Ant Var. 2024;5(2):62-65.

Abstract

This case report details multiple vascular anomalies discovered during routine abdominal dissection, including duplication of the inferior vena cava (IVC), the right testicular artery (RTA) originating from an accessory right renal artery, and unusual drainage of the right testicular vein into the right part of the double IVC. Currently, computed tomography and angiography are instrumental in diagnosing IVC duplication, highlighting its clinical significance with increased risks of deep vein thrombosis and pulmonary embolism. Understanding these variations from an embryological perspective is crucial for managing clinical cases and planning surgical interventions involving the posterior abdominal wall. This case study explores the embryological origins of these vascular anomalies. It discusses their potential clinical implications, emphasizing the importance of accurate imaging techniques and comprehensive anatomical knowledge in clinical practice..

Key Words: *Duplication of inferior vena cava; Vascular anomalies; Embryology*

Introduction

The inferior vena cava (IVC) is a major retroperitoneal vessel formed by the union of the right and left common iliac veins. This confluence typically occurs at the level of the L5 vertebra, situated approximately 2.5 cm to the right of the midline [1]. The vessel runs along the vertebral column's right anterolateral aspect and traverses the diaphragm's central tendon to enter the thorax around the T8 vertebral level. It serves as the main conduit for deoxygenated blood from the lower extremities and abdomen to the right atrium of the heart [2,3]. As the IVC ascends, it receives many tributaries including paired third and fourth lumbar veins, the right gonadal vein, paired renal veins, the right suprarenal vein, paired inferior phrenic veins, and three hepatic veins [3]. Anomalies of the IVC are rare in the general population, and most of the patients with this variant are asymptomatic and are incidentally detected by diagnostic imaging modalities. Anatomical variations of these vessels are important to consider they may cause lower extremity venous insufficiency, deep vein thrombosis, and pelvic congestion syndrome [4].

[1]*Department of Anatomy, Kairuki University, Tanzania*

[2]*Department of Anatomy and Histology, Mwanza University, Mwanza*

[*]*Corresponding author: George J Lufukuja, Lecturer & Head of Department of Anatomy, Kairuki University, PO Box: 65300, Dar es Salaam, Tanzania; E-mail: lufukuja70@yahoo.co.uk*

Received: July 04, 2024, Accepted: July 23, 2024, Published: August 07, 2024

Embryological basis of vascular variations

The complicated embryogenesis of the IVC might lead to the aberrant development of the organ. Embryogenesis of the IVC is from the fusion and subsequent regression of the following pairs of embryological veins, namely the posterior cardinal, subcardinal, supracardinal, and vitelline veins [3,5-7]. Similarly, the renal vessels, gonadal arteries, and veins also exhibit several variations. Considerable variations in the kidney's vascular patterns with multiple renal arteries are also common [8]. These variations are important in posterior abdominal wall operations and kidney transplantation [9].

Case Report

During a routine anatomy dissection for undergraduate medical students, in the Department of Anatomy, at the Kairuki University, Dar es Salaam Tanzania, an adult male autopsy was incidentally found to have double IVC associated with other multiple vascular variations. This case report describes multiple vascular anomalies found incidentally during routine anatomical dissection. The most significant finding is the duplication of the inferior vena cava (IVC). The right testicular artery originated from an accessory right renal artery, and the right testicular vein drained into the right part of the double IVC. The right IVC traveled up along the right side of the abdominal aorta, received the right testicular vein, and joined the left IVC to form a common trunk of IVC. The left IVC coursed superiorly on the left side of the abdominal, received the left renal vein, and then crossed anteriorly to the abdominal aorta to join the right IVC to form the common inferior vena cava (CIVC) (Figure 1).

Furthermore, we observed the presence of a right accessory renal artery that originated from the abdominal aorta immediately above the origin of the inferior mesenteric artery. This accessory renal artery looped anterior to the right IVC and deeper/posterior to the testicular vein towards the right kidney. The right testicular artery was observed to originate from the right accessory renal artery instead of its normal origin from the abdominal aorta (Figure 1). We also observed two separate divisions of the right and the left renal veins, which had emerged from the respective kidney's hilum. On the left side, the divisions ended into a common trunk forming the left renal vein before draining into the left IVC that drains into the CIVC.

Discussion

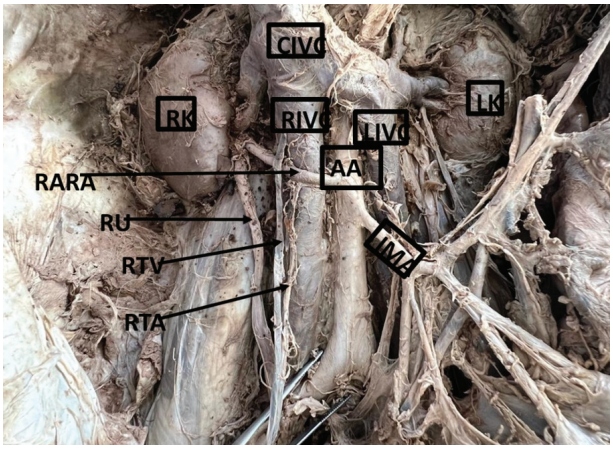

Figure 1) *Showing the left kidney (LK), right kidney (RK), common inferior vena cava (CIVC) formed by the union of the left inferior vena cava (LIVC) and the right inferior vena cava (RIVC). Other structures are the right accessory renal artery (RARA), right testicular artery (RTA), right ureter (RU), right testicular vein (RTV), abdominal aorta (AA), and inferior mesenteric artery (IMA).*

Embryogenesis of the IVC is from the fusion, anastomosis, and subsequent regression of three longitudinal pairs of fetal veins in a complex mechanism that gives rise to the IVC [5,10,11]. The incidence of dual IVC in the general population is estimated to be between 1% and 3% [6,7,12]. Persistence of veins that normally degenerate on the left side leads to duplication of the IVC [13]. In the present case, the double IVC was found only in the lower segment so that the degenerated parts appeared to continue only in the lower segment up to the level of the kidneys. Although it is incidentally discovered during imaging tests, the variant

has major clinical consequences [7,14]. It is imperative to recognize these variants, as failure to do so may jeopardize the patient's life during abdominal operations, especially retroperitoneal associated operations, and IVC filter placement [15]. Numerous case reports on IVC duplication have been published. IVC duplication is clinically relevant when combined with other vascular anomalies as revealed in this case report. These variants could be a challenge during retroperitoneal surgical procedures [16]. In summary, it's crucial to recognize that a duplicated IVC may be mistakenly identified as other conditions, such as lymphadenopathy, left pyeloureteric dilatation, retroperitoneal cysts, and loops of small bowel [17]. This may result in unwarranted or incorrect therapy, emphasizing the importance of precise diagnosis in such situations.

Conclusion

This case report reveals a duplicated inferior vena cava (IVC) associated with an accessory renal artery and unusual testicular artery and vein drainage patterns. These complex vascular anomalies underscore the need for detailed anatomical knowledge and advanced imaging techniques in clinical practice. Surgeons must be aware of such variations to avoid complications during retroperitoneal surgeries and IVC filter placements. Thorough preoperative imaging is crucial for identifying and addressing anatomical anomalies. Understanding the embryological development of the IVC and related vessels aids in recognizing these variations. Overall, this case highlights the importance of integrating comprehensive anatomical and embryological knowledge into clinical practice to ensure accurate diagnosis and effective management of vascular anomalies.

Acknowledgement

We express our gratitude to Miss Emmy Mwaipaja, for her valuable guidance and expertise in anatomical dissections. However, we believe that the findings of this case report will significantly impact clinical practices. Our discoveries will enhance understanding of how variant anatomical features may complicate management, particularly in surgical contexts.

References

1. Tucker WD, Shrestha R, Burns B. Anatomy, Abdomen and Pelvis, Inferior Vena Cava. StatPearls Publishing, Florida, USA. 2018.
2. Nigro B, Ayarragaray JEF. Anomalies of inferior vena cava: implications and considerations in retroperitoneal surgical procedures. Ann Vasc Surg. 2022;79:372-9.
3. Li SJ, Lee J, Hall J, et al. The inferior vena cava: anatomical variants and acquired pathologies. Insights into Imaging. 2021;12:1-22.
4. Tarazi M, Bashir A, Khan K, et al. A literature review and case series of DVT patients with absent IVC treated with thrombolysis. Ann Vasc Surg. 2020;67:521-31.
5. Moore KL, Dalley AF, Agur AMR. Clinically Oriented Anatomy. Lippincott Williams & Wilkins, Philadelphia, United States. 2013.
6. Balawender K, Pliszka A, Kłos M, et al. Duplication of the inferior vena cava - an anatomical case report with comments on embryological background and clinical implications. Transl Res Anat. 2022;29:100221.
7. Shafi I, Hassan AAI, Akers KG, et al. Clinical and procedural implications of congenital vena cava anomalies in adults: a systematic review. Int J Cardiol. 2020;315:29-35.
8. Abdessater M, Alechinsky L, Parra J, et al. Anatomical variations of the renal artery based on the surgeon's direct observation: a french perspective. Morphologie. 2022;106:15-22.
9. Sonje P, Kanasker N, Vatsalaswamy P. Variations in the origin and draining pattern of gonadal

vessels with their surgical significance and developmental correlations. Indian J Anat. 2020;9:39-43.

10. Azizova A, Onder O, Arslan S, et al. Persistent left superior vena cava: clinical importance and differential diagnoses. Insights into Imaging. 2020;11:1-19.

11. Coco D, Cecchini S, Leanza S, et al. Inferior vena cava duplication: Incidental case in a young woman. Case Rep Radiol. 2016;2016:1-4.

12. Shin DS, Sandstrom CK, Ingraham CR, et al. The inferior vena cava: a pictorial review of embryology, anatomy, pathology, and interventions. Abdom Radiol. 2019;44:2511-27.

13. Hegazy A. Clinical Embryology for Medical Students and Postgraduate Doctors. Lap Lambert Academic Publishing, Saarbrucken, Germany. 2014.

14. Dávalos GA, Muñoz CA, Cornejo FJ, et al. Abnormal development of the inferior vena cava and its implications on distal venous drainage during cardiac surgery and other clinical entities. J Surg Case Reports. 2019;2019:rjz289.

15. Kim H, Labropoulos N, Blake AM, et al. Prevalence of inferior vena cava anomalies and their significance and impact in clinical practice. Eur J Vasc Endovasc Surg. 2022;64:388-94.

16. Shen L, Zhou L, Liu X, et al. Comparison of biexponential and monoexponential DWI in evaluation of Fuhrman grading of clear cell renal cell carcinoma. Diagn Interv Radiol. 2017;23:100-5.

17. Klinkhachorn P, Ritz B, Umstot S, et al. Duplication of the inferior vena cava: evidence of a novel type IV. Folia Med Cracov. 2020;60:5-13.