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Duplication of Inferior Vena Cava- Its Clinical Importance

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Abstract: Duplication of Inferior vena cava (IVC) is rare variant and usually detected incidentally by imaging techniques for other reasons. The formation of Inferior vena cava is by the union of right and left common iliac veins posterior to right common iliac artery at the level of fifth lumbar vertebra. The present case describes the unusual formation and duplication of IVC which was encountered during routine dissection of male cadaver which was used to educate medical undergraduate students. Duplication of inferior vena cava on either side of the abdominal aorta up to the 2nd lumbar vertebra was observed. Inferior vena cava on the right side was formed by union of right common iliac vein with left internal iliac vein. Left external iliac vein continued as accessory venous channel of inferior vena cava on the left side of abdominal aorta. These types of variations may cause misdiagnosis, unwanted hemorrhage during retroperitoneal surgeries due to ligation.
Keywords: Double inferior vena cava, Variation, Retroperitoneal surgeries

INTRODUCTION

IVC is formed by the union of right and left common iliac veins posterior to the right common iliac artery. Formation is located at the level of fifth lumbar vertebra on the posterior abdominal wall. IVC ascends on the right side of the abdominal aorta, forming a groove in the posterior surface of liver.

It enters thoracic cavity by piercing the central tendon of diaphragm at the level of eighth thoracic vertebra to terminate into the right atrium of the heart [1]. Development of IVC from posterior cardinal, sub-cardinal and supra-cardinal veins and various anastomoses between these veins is a complex process which occurs during 6th to 10th week of embryogenesis. Any alteration during its embryogenesis may lead to variations in the final development of the IVC. Duplication of IVC is one such relatively rare condition which is clinically silent and diagnosed incidentally by imaging techniques done for other reasons. Duplication of IVC has incidence of 0.2% to 3 % in the general population [2]. Variations in the formation of IVC are hence indicative of defective angiogenesis and are of immense surgical importance especially in retroperitoneal surgeries and in cases of thromboembolism [3].

CASE REPORT

An unusual pattern of duplication of venous channel was observed on either side of the abdominal aorta near its termination on the posterior abdominal wall during routine dissection of a male cadaver in the Department of Anatomy, Sree Narayana Institute of Medical Sciences which was used to educate medical undergraduate students. The formation of inferior vena cava was rare and unusual. Inferior vena cava was formed by the union of right common iliac vein and left internal iliac vein on the right of abdominal aorta at the level of fifth lumbar vertebra. A small communicating channel was observed between the left external iliac and internal iliac veins posterior to left external iliac artery. The left external iliac vein didn't join left internal iliac vein to form common iliac vein rather it ascended separately on the left side of abdominal aorta and vertebral column as accessory venous channel called left inferior vena cava. Left inferior vena cava and left renal vein united to form common trunk at the level of second lumbar vertebrae. Common trunk terminated by draining into inferior vena cava on the right side of abdominal aorta after crossing anterior to abdominal aorta. The left set of lumbar veins drained into left inferior vena cava as tributaries. The right testicular vein drained into right part of inferior vena cava and left testicular vein drained into left renal vein.

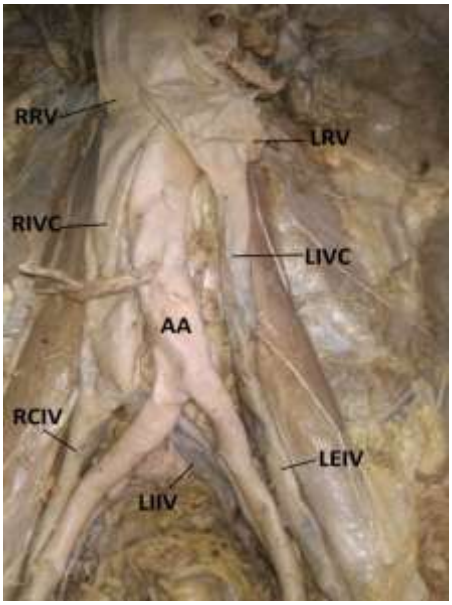

Fig-1: Showing the duplication of inferior vena cava

DISCUSSION

Embryogenesis of IVC during 6th to 10th week of gestation is complex process of appearance of three pairs of primitive veins (posterior cardinal, sub-cardinal and supra-cardinal veins) interconnecting, anastomosing and followed by regression. [4] Development of the IVC can be broadly divided from cranio-caudally into the common hepatic, hepatic, renal and the post renal segments. In the present case the common hepatic and hepatic segment of IVC are normal in development. Below the level of liver two separate IVC's are present on either side of the abdominal aorta possessing the usual tributaries (renal veins, suprarenal and gonadal veins). On the right side the development of renal and post-renal part of the IVC is almost normal (i.e., right posterior sub-cardinal vein and right supra-subcardinal anastomoses). The right common iliac vein was derived from the caudal part of right posterior cardinal vein caudal to the inter-posterior cardinal venous anastomoses. The renal segment on the left side was derived from the inter-subcardinal anastomoses (pre-aortic anastomoses), which normally constitutes the part of the left renal vein crossing anterior to the abdominal aorta [5]. Post renal segment is developmentally almost similar to that of the right side. The IVC's of the two sides are interconnected by a venous channel which is the persistent inter posterior cardinal venous channel. First to appear are the posterior cardinal veins: all but their most distal portion regress and forms the iliac bifurcation. Next, the sub-cardinal veins form anteromedial to the posterior cardinal veins: the right sub-cardinal forms the suprarenal IVC while its left counterpart regresses. Lastly, the supra-cardinal veins develop dorsal to the sub-cardinal veins, with the right vein forming the infrarenal IVC while the left vein regresses. Failure of regress of any of three left venous counterparts is thought to be responsible for congenital abnormalities of the vena cava [6]. The left inferior vena cava in the present case formed is a mirror image of the right receiving corresponding vessels: thus the ovarian vessels each joining the IVC on its own side. In the present case and in most reports of duplicated IVC, the left inferior vena cava usually crosses over to join with its right counterpart at the level of the renal vein [7], although there have been incidences of it crossing at a lower level [8]. Natsis K et al. classified the duplication of IVC as complete and incomplete bilateral duplication of the IVC. Complete bilateral duplication was further classified into three types. Type I or major duplication; comprises two bilaterally symmetrical and approximately of the same caliber trunks and a preaortic trunk of the same caliber. In this type, the left and the right IVCs are just near the lateral border of the aorta. Type II or minor type; comprises two bilaterally symmetrical and approximately of the same caliber trunks, but is smaller in comparison to the preaortic trunk. In this type the prominent venous trunk is the preaortic trunk. Type III or asymmetric type; comprises small left IVC, larger right IVC and even larger preaortic trunk or small left IVC, larger preaortic trunk and even larger right IVC. In type III, the prominent vessel is either right IVC or the preaortic trunk. In the two latter types, the left and right IVCs may have enough distance from the lateral border of the aorta. It is therefore obvious that IVC duplication should be defined not only with regard to the size of the right and left IVC, but basically it should be based on the presence of the preaortic trunk. Our case represents type III according to the above classification but there is difference in the formation of left IVC as in our case left IVC is continuation of left external iliac vein and not left common iliac vein [9]. Based on the gross appearance as we described, it seems that although failure of regression of the left IVC can result in the incomplete duplication of the IVC, in our case the etiologic factor we assume is that the complete bilateral

duplication results from persistence of the left suprasubcardinal and postsubcardinal anastomoses and probably of the intersubcardinal anastomosis, which in turn results in persistence of the left supracardinal vein. Radiologically, the presence of double IVC can be mistaken as a pathological lesion such as lymphadenopathy [10, 11] or left pyelo-ureteric dilatation [12]. The presence of double IVC may also complicate retroperitoneal surgery. The double IVC can be inadvertently injured or ligated during retroperitoneal surgery [13]. Moreover, there are several case reports of thromboembolic events occurring in patients with double IVC. There appears to be an increased incidence of thrombosis formation in double IVC, but the exact cause is unknown [14]. Therefore, it is very important to have a comprehensive knowledge about the variations in the anatomy of IVC.

CONCLUSION

Duplication of inferior vena cava is usually detected incidentally by imaging for other abdominal reasons or while conducting post-mortem or during routine dissection. It is important to have adequate knowledge about variations in the developmental anatomy of IVC so that pre-operative diagnosis can assist in safe surgical interventions.

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ABREVATIONS

RRV- Right Renal Vein, AA- Abdominal aorta, LRV- Left Renal Vein, RIVC- Right Inferior Vena Cava, LIVC- Left Inferior Vena Cava, LEIV- Left External Iliac Vein, LIIV- Left Internal Iliac Vein, LTV- Left testicular vein.

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