Original Article

Indian Journal of Anatomy
Volume 5 Number 1, January - April 2016
DOI: http://dx.doi.org/10.21088/ija.2320.0022.5116.2

Duplication of Inferior Vena Cava

Anupama Chauhan*, Shobha Rawlani, Bharat Sontakke*, Shivlal Rawlani*****

Abstract

Double inferior vena cava is rare congenital variation resulting from the persistence of the embryonic cardinal venous system. Duplication of inferior vena cava is rare occurrence where the left side cardinal venous system persists as the left inferior vena cava.

This study was carried out in the Department of Anatomy, Dr. P. D. M. M. C. Amravati. Total thirty male adult cadavers were dissected to study the inferior vena cava. Out of thirty, in one cadaver, the duplication of inferior vena cava was observed. This anomaly was discussed along with its embryological basis. Apart from duplication of inferior vena cava, no any other anomaly was found.

Keywords: Inferior Vena Cava; Congenital Variation; Duplication.

Introduction

The inferior vena cava is formed by the union of right and left common iliac veins 11 slightly below the level of bifurcation of the aorta, in front of body of fifth lumbar vertebra, about 2.5 cm to the right of the median plane. It conveys the venous blood to the right atrium from all parts of the body below the diaphragm [1]. The inferior vena cava develops during fifth to seventh week of development from many sources [2]. An anomaly of inferior vena cava is not infrequent and has been estimated to occur in only about two to three percent of persons [11].

An accurate preoperative diagnosis can be made if computed tomography assessment of vascular structure is made by using intravenous contrast material during the arterial phase [3]. Not only the Radiologist but also surgeons dealing with this regions must also be familiar about this anomalies, as high index of suspicion on the surgeons required to prevent inadvertent injury to these anomalous veins and to avoid significant hemorrhage during retroperitoneal surgery [4,8,9].

Detailed knowledge of these anomalies is crucial for inferior vena cava filter placement .spermatic vein embolization, and adrenal or renal venous sampling [10]. Anomalies of the inferior vena cava and renal veins occur infrequently but unidentified can lead to significant morbidity during surgical exploration [11].

Materials and Methods

The present study was carried out in the Department of Anatomy, Dr. P. D. M. M. C. Amravati. Total thirty adult cadavers were dissected for study of the inferior vena cava, out of which in one cadaver, the duplication of inferior vena cava was observed. Apart from duplication of inferior vena cava, no any other anomaly was found.

Results

In present study, it was observed that the right and the left common iliac veins were joined on the right side of abdominal aorta at the level of fifth lumbar vertebra to form the inferior vena cava which ascended up on the right side of abdominal aorta.

Author's Affiliation: *Assistant Professor., **Professor and Head, Dept. of Anatomy, Dr. P.D.M.M.C Amravati. ***Associate Professor, Department of Oral Medicine & Radiology, Sharad Pawar Dental College& Hospital, Sawangi (M), Wardha, Maharashtra, India.

Corresponding Author: Shivlal M. Rawlani, *Associate Professor, Department of Oral Medicine & Radiology, Sharad Pawar Dental College& Hospital, Sawangi (M), Wardha-442001, Maharashtra, India.
E-mail: drrawlani2007@rediffmail.com

There was another abnormal venous channel (referred as duplicated inferior vena cava) arising from the left common iliac vein which ascended up parallel to the left side of abdominal aorta. This abnormal venous channel ended by draining into the left renal vein. Left phrenic vein also drained into left renal vein whereas left suprarenal vein drained into left phrenic vein, instead of draining into the left renal vein normally. Left gonadal vein was opening into the left renal vein close to this abnormal venous channel, that the duplicated inferior vena cava.

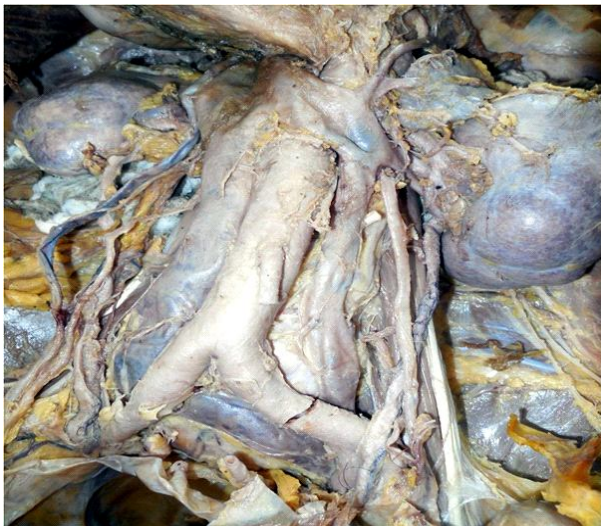

Fig. 1: Showing duplicated inferior vena cava Lt to aorta

Discussion

Embryological Basis of Doubling of Inferior Vena Cava

The inferior vena cava develops during fifth to seventh week of development from many sources like right posterior cardinal vein, right supracardinal vein, right subcardinal-supracardinal anastomosis, right subcardinal vein, subcardinal hepatocardiac anastomosis and right hepatocardiac channel. Any deviation in this complex process of embryogenesis may lead to variations in the inferior vena cava. So anomalies of inferior vena are produced as consequence of its complicated mode of development.

Duplication of the inferior vena cava results from persistence of both sided supracardinal veins[2]. In present study, it was observed that the right and the left common iliac veins were joined on the right side of abdominal aorta at the level of fifth lumbar vertebra to form the inferior vena cava which ascended up on the right side of abdominal aorta. There was another abnormal venous channel (referred as duplicated inferior vena cava)arising from the left common iliac vein which ascended up parallel to the left side of abdominal aorta.(Fig.1). This abnormal venous channel ended by draining into the left renal vein. Left phrenic vein also drained into left renal vein whereas left suprarenal vein drained into left phrenic vein, instead of draining into the left renal vein normally.

Left gonadal vein was opening into the left renal vein close to this abnormal venous channel, that the duplicated inferior vena cava (Fig. 1). Bass J E et al . reported many congenital anomalies of inferior vena cava like left sided inferior vena cava, azygous continuation of inferior vena cava, absence of the infrarenal inferior vena cava or the entire inferior vena cava, also reported double inferior vena cava as like us which is 0.2 to 3 percent prevalent [3].

According to the Bass J E et al., two common iliac veins failed to unite at the level of the aortic bifurcation. The two venae cavae ascend on both sides of the aorta. The left inferior vena cava drains into the left renal vein. The left renal vein crosses anterior to the aorta to form the normal right prerenal inferior vena cava. This arrangement of the left renal vein crossing anterior to the inferior vena cava to form normal right prerenal inferior vena cava is the commonest arrangement in the duplication of inferior vena cava [3].

According to Klimberg and Cohen et al., duplication of the inferior vena cava is one such relatively rare condition which in majority of cases is clinically silent and diagnosed incidentally by imaging (including computed tomography and magnetic resonance imaging) done for other reasons. This anomaly has significant clinical implications.

Radiologically, the presence of double inferior vena cava can be mistaken as a pathological lesion such as lymphadenopathy [5]or left pyelo-ureteric dilatation [6]. The presence of double inferior vena cava may also complicate the retroperitoneal surgery. The double Inferior vena cava can be inadvertently injured or ligated during retroperitoneal surgery [6]. Variations in the inferior vena cava are hence indicative of defective angiogenesis and are of immense surgical importance especially in retroperitoneal surgeries and in cases of thromboembolism.

Complexity of embryogenesis of the inferior vena cava, accounts for the great diversity in its anomalies. Among the most common anomalies, incidence are 0.69% in left sided inferior vena cava, 1.03% in double inferior vena cava, and 0.08% in azygous continuation. The knowledge of anomalies of inferior vena cava is important in both diagnostic and operative purposes. The modern techniques like CT scan and MRI have helped the doctors to diagnose its variations [7] .

The vast variability of the overall rare congenital anomalies of the IVC is mostly detected through different imaging modalities. These variations cannot be classed as pathological findings, and should not be confused with lymphomas and has to differ from secondary collateral venous pathways. Knowledge of caval anomalies can prevent misinterpretation of mediastinal masses, iliac occlusion with venouscollaterals, or Para vertebral lymph node

Conclusion

One should be aware of double inferior vena cava as a rare anatomical variant that may have significant surgical implications. If double inferior vena cava is not preoperatively recognized, it can be a source of severe surgical complications.

References

1. Hollinshead WH. Anatomy For Surgeons: the thorax, abdomen and pelvis. In the kidneys, ureters and suprarenal gland. *2nd edition, Volume 2. Harper & Row Publishers.* 1971: 584-92.
2. Sadler TW. Langman's Medical Embryology. In Cardiovascular System. 10th edition. *Wolters Kluwer Health (India) Publishers*, 2006: 159-89.
3. Bass JE, Red wine MD, Kramer LA, Huynh PT and Harris JH. Spectrum of congenital anomalies of the inferior vena cava: cross sectional imaging findings. *Radiographics* 2000; 20: 639-52.
4. Shingleton WB, Hutton M, Resnick MI.. Duplication of inferior vena cava: its importance in retroperitoneal surgery. *Urology* 1994; 43: 113-15.
5. Klimberg I Wajsman Z(1986). Duplicated inferior vena cava simulating retroperitoneal lymphadenopathy in a patient with embryonal cell carcinoma of testical.Journal of urology 136 678-679.
6. Cohen SI,Hochsztein P,Cambio J,Sussett J (1982). Duplicated inferior vena cava misinterpreted by computerized tomography as metastatic retro-peritoneal testicular tumor. Journal of urology 128389-391.
7. Kumar S Medical Journal. 2006; 4(2, Issue 14): 253-255.
8. Babaian RJ, Johnson DE. Major venous anomalies complicating retroperitoneal surgery. South Med J. 1979; 72: 1254-1258.
9. Bastounis E, Pikoulis E, Leppaniemi A, Maltezos C, Milas F, Alexiou D. Anomalous inferior vena cava complicating abdominal aortic aneurys-mectomy. J Cardiovasc Surg (Torino). 1997; 38: 367-369.
10. Trigaux JP, Vandroogenbroek S, De Wispelaere JF, Lacrosse M, Jamart J. Congenital anomalies of the inferior vena cava and left renal vein- evaluation with spiral CT. J Vasc Interv Radiol. 1998; 9: 339-345.
11. Mathews R, Smith PA, Fishman EK, Marshall FF. Anomalies of the inferior vena cava and renal veins: embryologic and surgical considera-tion. Urology. 1999; 53: 873-880.